ADDENDUM #1
RFP NUMBER: 2014020-PU-P
North River Pump Station Upgrade Construction/Installation RFP
PROJECT 473-12-13
CONTRACT 1

DATE: February 27, 2014

TO: All Potential Proposers

City of Harrisonburg's North River Pump Station Upgrade Construction/Installation RFP (2014020-PU-P), is modified as follows:

SITE MEETING & PRE-BID QUESTIONS:

1. Note: Correct e-mail address for contacting Director of Utilities, Mike Collins is: mike.collins@harrisonburgva.gov not as originally listed on Page A-7 in RFP.

2. The requirement to submit electronic copy of the proposal as identified on Page A-9 of the RFP (Section F, Para 4) has been waived, copies of the proposal on CD-ROM or USB drive are no longer required.

3. Bidders are encouraged to provide a thorough and detailed execution schedule for the installation contract with their technical proposal, indicating coordination dates required for integration of related project procurements. This detailed schedule will be a core element of the bid evaluation process (Quality Factors). Detailed schedules may be submitted after receipt of the technical proposal; however, submittal with the closing will incur additional value in the evaluation. The City may request additional schedule detail or clarifications after completion of the technical evaluation of the proposals.

4. The contractor on this project (Installation Contract 1) will be responsible for pickup, transport, delivery and installation of owner furnished contractor installed (OFCI) equipment identified in specifications to be provided on Contracts 2, 3 and 4. Upon acceptance inspection at City Central Stores and loading onto the contractor's designated transport, the contractor will be responsible for transport, off-loading, storage and installation of the OFCI equipment in accordance with contract documents. City personnel will assist with loading of material onto the contractor's transport but upon loading the contractor is responsible for protection of all equipment from loss and damage in shipping, storage and installation until final City acceptance of installed equipment. Upon contractor acceptance any damages that occur to OFCI equipment prior to City acceptance shall be corrected as directed by the City at contractor expense.

5. Available submittal information from Contracts 2, 3, 4 will be provided to the contractor for coordination. The only material available at this time is the enclosed draft bill of materials for the VFD and electrical gear procured on Contract 3. The full RFPs for Contract 2 and Contract 3 are available on the City's website at the web addresses listed below.

North River Pump Station Viable Frequency Drives & Electrical Gear RFP (Contract 2): www.harrisonburgva.gov/north-river-pump-vfd-2013

North River Pump Station Motor Replacement RFP (Contract 3): www.harrisonburgva.gov/north-river-pump-station-motor-replacement-rfp-2014

6. Regarding pre-bid question on arrangement of incoming power supply from Dominion Virginia power, (Dominion); Dominion will be providing the service transformer with integral CT enclosure for the main power metering. The Installation Contractor will responsible for coordinating service entry points, conduit and conductor points for this equipment. Basis of design has followed Dominion's "Blue Book" regarding layout of the service transformer, CT enclosure and meter base on the elevated platform. No further details are available at this time on the Dominion service entry.

DRAWINGS:

1. Drawing D-101: Under Sequence of Construction delete Phases 1 thru 6 in their entirety and replace with the attached "Equipment Installation and Commissioning Sequence". (Conformed drawings noting this update will be issued for construction)

2. Drawing E-101: Note 2 shall apply to all four (4) emergency light fixtures shown on the Floor Plan – Lighting. (Conformed drawings noting this update will be issued for construction)

3. Drawing E-101, E-601 and E-602: The circuit designations for Pumps P-1, P-2 and P-3 shall be in accordance with the One-Line Diagram on Drawing E-601 and Panel Schedules on Drawing E-602. The circuit designation for the VFD for Pump P-1 shall be revised to "EDP-1/PS-6 VIA MTS". The circuit designation for the VFD for Pump P-3 shall be revised to "PS-1". (Conformed drawings noting this update will be issued for construction)

4. Drawing E-101: PLC I/O Schedule Items 18 and 19 shall be revised to refer to VFD-3; PLC I/O Schedule Items 22 and 23 shall be revised to refer to VFD-1. (Conformed drawings noting this update will be issued for construction)

ATTACHMENTS:

1. List of pre-bid meeting attendees and copy of pre-bid meeting agenda.

2. Equipment Installation and Commissioning Sequence

3. Draft Bill of OFCI Materials to be provided on Contract 2 for VFD and Electrical Gear

4. Draft Bill of OFCI Materials to be provided on Contract 4 for SCADA contract

5. RFP No. 2014015 Contract 2 for VFD and Electrical Gear

End of Addendum #1

All other requirements, terms and conditions of the RFP remain unchanged.

Addendum page must be signed and returned with your proposal to acknowledge receipt of this addendum.

_____

Authorized Signature

By: Pat Hilliard, CPPB
Purchasing Agent

LIST OF PRE-BID CONFERENCE ATTENDEES
City of Harrisonburg - North River Pump Station Upgrade
Contract 1 - Installation Contract
February 20, 2014 - 10 AM
Water Operations Center Beery Road

Company Name: Momentum Earthworks General Contractor ( ) Subcontractor (X) Supplier ( )

Address: 1500 Pleasants Dr.

Telephone Number: 540-810-0861 Fax Number:

Attendee Name: Jordan Lehman Email: jlehman@momentumearthworks.com

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Company Name: Momentum Earthworks General Contractor ( ) Subcontractor (✓) Supplier ( )

Address: 1500 PLEASANTS DRIVE

Telephone Number: 540 564-1986 Fax Number: 540 564-1317

Attendee Name: PAT TRACY Email: Tracy@momentumEarthworks.com

Company Name: Riddleberger Bros General Contractor ( ) Subcontractor (✓) Supplier ( )

Address: 6127 S Valley Pike Mt Crawford

Telephone Number: 540 574 5968 Fax Number:

Attendee Name: Brian Ritter Email: ritterb@rbiva.com

Company Name: Mid Valley Electric General Contractor ( ) Subcontractor (✓) Supplier ( )

Address: 1180 S. High ST

Telephone Number: 540 433-6815 Fax Number: 540 433-5599

Attendee Name: Tracy Huffer Email: thuffer@midvalleyelectric.net

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Company Name: City Harrisonburg General Contractor ( ) Subcontractor ( ) Supplier ( )

Address:

Telephone Number: 824-2767 Fax Number:

Attendee Name: Doug Adams Email: Doug.adams@Harrisonburgva.gov

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Company Name: Allen Yoho Electric General Contractor ( ) Subcontractor (✓) Supplier ( )

Address: 88 Commonwealth Drive Lyndhurst VA

Telephone Number: 540-949-6782 Fax Number: 540-949-6784

Attendee Name: Robert Morris Email: bobby@allenyoho.com

LIST OF PRE-BID CONFERENCE ATTENDEES
City of Harrisonburg - North River Pump Station Upgrade
Contract 1 - Installation Contract
February 20, 2014 - 10 AM
Water Operations Center Beery Road

Company Name: DESIGN ELECTRIC General Contractor ( ) Subcontractor (X) Supplier ( )

Address: 49 WILSHIRE CT. FISHERSVILLE, VA 22939

Telephone Number: 540-209-4109 Fax Number: 540-337-2122

Attendee Name: ROBERT SEWARD Email: RSEWARD@DESIGNELECTRICINC.COM

Company Name: Anderson Const Inc. General Contractor ( ) Subcontractor ( ) Supplier ( )

Address: PO Box 10053 Lynchburg Va, 24506

Telephone Number: 434 239 4913 Fax Number: 434 239 2683

Attendee Name: Lowell Jones Email: andconstr@msn.com

Company Name: TRUMBO ELECTRIC General Contractor ( ) Subcontractor (X) Supplier ( )

Address: P.O. Box 38, BROADWAY, VA 22815

Telephone Number: 540-896-7095 Fax Number: 540-896-9546

Attendee Name: J. W. FISKE Email: JWF@TRUMBOELECTRIC.COM

Company Name: Fielder's Choice Enterprises, Inc. (FCE, INC.) General Contractor (X) Subcontractor ( ) Supplier ( )

Address: 1020 Linden Avenue, Charlottesville, VA 22902

Telephone Number: 434-244-0250 Fax Number: 434-977-3783

Attendee Name: Chris Desper Email: cdesper@fce-digs.com

Company Name: General Contractor ( ) Subcontractor ( ) Supplier ( )

Address:

Telephone Number: Fax Number:

Attendee Name: Email:

Company Name: General Contractor ( ) Subcontractor ( ) Supplier ( )

Address:

Telephone Number: Fax Number:

Attendee Name: Email:

LIST OF PRE-BID CONFERENCE ATTENDEES
City of Harrisonburg - North River Pump Station Upgrade
Contract 1 - Installation Contract
February 20, 2014 - 10 AM
Water Operations Center Beery Road

Company Name: Public Utilities General Contractor ( ) Subcontractor ( ) Supplier ( )

Address: 2155 Beery Rd.

Telephone Number: 434 9959 Fax Number: ______

Attendee Name: Jamie Fultz Email: ______

Company Name: ______ General Contractor ( ) Subcontractor ( ) Supplier ( )

Address: ______

Telephone Number: ______ Fax Number: ______

Attendee Name: ______ Email: ______

Company Name: ______ General Contractor ( ) Subcontractor ( ) Supplier ( )

Address: ______

Telephone Number: ______ Fax Number: ______

Attendee Name: ______ Email: ______

Company Name: ______ General Contractor ( ) Subcontractor ( ) Supplier ( )

Address: ______

Telephone Number: ______ Fax Number: ______

Attendee Name: ______ Email: ______

Company Name: ______ General Contractor ( ) Subcontractor ( ) Supplier ( )

Address: ______

Telephone Number: ______ Fax Number: ______

Attendee Name: ______ Email: ______

Company Name: ______ General Contractor ( ) Subcontractor ( ) Supplier ( )

Address: ______

Telephone Number: ______ Fax Number: ______

Attendee Name: Email: ______

EQUIPMENT INSTALLATION AND COMMISSIONING SEQUENCE

GENERAL

1. Install all electrical gear and SCADA gear
2. Install and Start-Up Unit #1 (VFD/Motor/Pump)
3. Install and Start-Up Unit #2 (VFD/Motor/Pump)
4. Independent generator operational test in new configuration
5. Decommission existing MTS, connect generator to ATS for Unit #1 and concurrently MTS for Unit #2, and test Unit #1 on new ATS
6. Install and Start-Up Unit #3 (VFD/Motor/Pump) – this is the pump currently on MTS/generator power
7. City operational testing

PHASE 1:

1) PRE-REQUISITES:
   - CONTRACT 1: STRUCTURAL WORK COMPLETE (RE: S-001, S-101, S-501 AND S-502)
   - CONTRACT 1: MECHANICAL WORK COMPLETE (RE: M-101, M-601)
   - CONTRACT 1: ELECTRICAL WORK WITH PUBLIC UTILITY TO DELIVER POWER TO ALL TERMINAL POINTS THAT ARE LOCATED IN THE NEW BUILDING ADDITION (RE: E-102, E-601, E-602), INCLUDING LIGHTING, HVAC AND CONTROL PANELS. IN ADDITION, EMERGENCY POWER CONDUCTORS AND CONTROLS SHALL BE IN PLACE READY FOR CONNECTION OF GENERATOR IN FUTURE PHASE WITH MINIMAL DOWNTIME.
   - CONTRACT 1: SCADA INSTALLED COMPLETE BEGINNING AT AND INCLUDING THE COMMUNICATIONS TOWER AND THEN EXTENDING TO SCADA RTU AND THEN TO ALL TERMINATIONS THAT ARE LOCATED IN THE NEW BUILDING ADDITION (RE: E-101).
   - CONTRACT 2: VFDS (3) & MATERIALS ON SITE WITH CERTIFIED SHOP TEST REPORTS
   - CONTRACT 3: NONE REQUIRED
   - CONTRACT 4: SCADA HARDWARE PROGRAMMED AND TESTED READY FOR OPERATIONS

2) WORK:
   - CONTRACT 1 SHALL COORDINATE WITH ELECTRICAL COMPANY TO PROVIDE POWER TO NEW ELECTRICAL GEAR AND VFDS INCLUDED IN THIS PROJECT. THIS WILL REQUIRE DUAL SERVICE CONNECTIONS TO THE BUILDING DURING COMMISSIONING. EXISTING SERVICE TO REMAIN IN PLACE UNTIL SUCCESSFUL COMMISSIONING OF PUMP #3 IS COMPLETE. MOUNT AND CONNECT VFDS.
   - CONTRACT 1 TO INSTALL VFD UNITS WITH POWER COMPLETE.

- CONTRACT 2 REPRESENTATIVE SHALL CONDUCT FUNCTIONAL TESTING OF ALL VFD UNITS.

3) DELIVERABLES:

- NEW BUILDING INITIATED WITH ALL POWER, LIGHTING, CONTROL PANELS INCLUDING ENERGIZED VFD.
- CONTRACT 2 REPRESENTATIVE ISSUING "CERTIFICATE OF PROPER INSTALLATION" FOR ALL VFD UNITS.

PHASE 2:

4) PRE-REQUISITES:

- CONTRACT 1 AND 2: PHASE 1 DELIVERABLES
- CONTRACT 3: MOTOR #1 & MATERIALS ON SITE WITH CERTIFIED SHOP TEST REPORT

5) WORK:

- CONTRACT 1: EXTEND ELECTRICAL WORK FROM VFD #1 TO MOTOR #1, EXTEND SCADA CONDUCTORS TO ALL TERMINAL POINTS EXCEPT THOSE SPECIFIC FOR PUMPS #2 AND #3, REMOVE EXISTING PUMP #1 MOTOR (RETURN TO OWNER), INSTALL NEW MOTOR, INSTALL NEW CHECK VALVE FOR PUMP #1 PIPING AND CONNECT PUMP #1 CIRCUIT TO NEW ATS/EMERGENCY GENERATOR.
- CONTRACT 2: MOTOR PROVIDER REPRESENTATIVE TO PERFORM 48 HOUR FUNCTIONAL TEST.
- ENERGIZE MOTOR #1 UNDER ACTUAL PUMP CONNECTION AND VFD CONTROL FOR CONTINUOUS 14 DAY PERIOD
- CONTRACT 2 & 3: PROVIDER REPRESENTATIVES FOR MOTORS AND VFDS TO CONDUCT PERFORMANCE TESTING DURING 14 DAY RUN PERIOD.

6) DELIVERABLES:

- CONTRACT 1: PROPERLY OPERATING UNIT #1 PUMP / MOTOR / CONTROLS
- CONTRACT 2: VFD REPRESENTATIVE ISSUES "CERTIFICATE OF PROPER OPERATION" FOR UNIT #1.
- CONTRACT 3: MOTOR REPRESENTATIVE ISSUES "CERTIFICATE OF PROPER OPERATION" FOR UNIT #1.
- CONTRACT 4: SCADA REPRESENTATIVE ISSUES "CERTIFICATE OF PROPER OPERATION" FOR UNIT #1 AND OTHER CONNECTED INPUTS/OUTPUTS.

PHASE 3:

7) PRE-REQUISITES:

- CITY: INSTALL PUMP SN TD-1111 INTO PUMP SLOT #2.
- CONTRACT 3: MOTOR #2 & MATERIALS ON SITE WITH CERTIFIED SHOP TEST REPORT
- CONTRACTS 1,2,3 AND 4: PHASE 2 DELIVERABLES

8) WORK:

- CONTRACT 1: EXTEND ELECTRICAL WORK FROM VFD #2 TO MOTOR #2, EXTEND SCADA CONDUCTORS TO TERMINAL POINTS FOR PUMP #2, REMOVE EXISTING PUMP #2 MOTOR (RETURN TO OWNER), INSTALL NEW MOTOR, INSTALL NEW CHECK VALVE FOR PUMP #2 PIPING, AND CONNECT PUMP #2 CIRCUIT TO NEW MTS/EMERGENCY GENERATOR.
- CONTRACT 2: MOTOR PROVIDER REPRESENTATIVE TO PERFORM 48 HOUR FUNCTIONAL TEST.
- ENERGIZE MOTOR #2 UNDER ACTUAL PUMP CONNECTION AND VFD CONTROL OPERATIONS FOR CONTINUOUS 7 DAY PERIOD
- CONTRACT 2, 3, & 4: PROVIDER REPRESENTATIVES FOR MOTORS AND VFDS TO CONDUCT PERFORMANCE TESTING DURING 7 DAY RUN PERIOD.

9) DELIVERABLES:

- CONTRACT 1: PROPERLY OPERATING UNIT #2 PUMP / MOTOR / CONTROLS
- CONTRACT 2: VFD REPRESENTATIVE ISSUES "CERTIFICATE OF PROPER OPERATION" FOR UNIT #2.
- CONTRACT 3: MOTOR REPRESENTATIVE ISSUES "CERTIFICATE OF PROPER OPERATION" FOR UNIT #2.
- CONTRACT 4: SCADA REPRESENTATIVE ISSUES "CERTIFICATE OF PROPER OPERATION" FOR UNIT #2.

PHASE 4:

10) PRE-REQUISITES:

- CONTRACTS 1,2,3 AND 4: PHASE 3 DELIVERABLES; CITY INDEPENDENT LOAD TEST OF NEWLY INSTALLED GENERATOR

11) WORK:

- CONTRACT 1: DEMOLISH EXISTING MTS AND CIRCUIT GEAR FROM EXISTING GENERATOR CONNECTION (RETURN TO OWNER); RELOCATE GENERATOR TO NEW LOCATION AND MAKE CONNECTION TO ATS/MTS FOR PUMPS #1 AND #2. OPERATE NEW PUMP #2 FOR 24 HOURS ON NEW GENERATOR CIRCUIT.
- CONTRACT 4: INITIATE GENERATOR CONTROL AND MONITOR FUNCTIONS INTO SCADA.

12) DELIVERABLES:

- CONTRACT 1: PROPERLY OPERATING UNIT #1 AND #2 PUMP / MOTOR / CONTROLS ON GENERATOR POWER SUPPLY AND SCADA CONTROL / MONITORING.

PHASE 5:

1) PRE-REQUISITES:
   - CONTRACT 3: MOTOR #3 & MATERIALS ON SITE WITH CERTIFIED SHOP TEST REPORT
   - CONTRACT 1: PHASE 4 DELIVERABLE

2) WORK:
   - CONTRACT 1: EXTEND ELECTRICAL WORK FROM VFD #3 TO MOTOR #3, EXTEND SCADA CONDUCTORS TO TERMINAL POINTS FOR PUMP #3, AND REMOVE EXISTING PUMP #3 MOTOR (RETURN TO OWNER), INSTALL NEW MOTOR, INSTALL NEW CHECK VALVE FOR PUMP #3 PIPING,
   - CONTRACT 2: MOTOR PROVIDER REPRESENTATIVE TO PERFORM 48 HOUR FUNCTIONAL TEST.
   - ENERGIZE MOTOR #3 UNDER ACTUAL PUMP CONNECTION AND VFD CONTROL OPERATIONS FOR CONTINUOUS 7 DAY PERIOD
   - CONTRACT 2 & 3: PROVIDER REPRESENTATIVES FOR MOTORS AND VFDS TO CONDUCT PERFORMANCE TESTING DURING 7 DAY RUN PERIOD.

3) DELIVERABLES:
   - CONTRACT 1: PROPERLY OPERATING UNIT #3 PUMP / MOTOR / CONTROLS
   - CONTRACT 2: VFD REPRESENTATIVE ISSUES "CERTIFICATE OF PROPER OPERATION" FOR UNIT #3.
   - CONTRACT 3: MOTOR REPRESENTATIVE ISSUES "CERTIFICATE OF PROPER OPERATION" FOR UNIT #3.
   - CONTRACT 4: SCADA REPRESENTATIVE ISSUES "CERTIFICATE OF PROPER OPERATION" FOR UNIT #3.

PHASE 6:

- CITY: MAY OPTION TO CONDUCT A PUMP / MOTOR CONDITION ASSESSMENT ANALYSIS TO INCLUDE ONE OR MORE OF THE FOLLOWING:
  - PUMP TESTING FOR CAPACITY, HEAD, BRAKE HORSEPOWER, EFFICIENCY, VIBRATION AMPLITUDE OF PUMP AND DRIVER, VIBRATION FREQUENCY ANALYSIS, AND OVERVIEW OF SEAL AND LUBE SYSTEMS.
  - MOTOR TESTING FOR STANDARD CIRCUIT TESTING, POLARIZED INDEX TESTING, STEP VOLTAGE, VOLTAGE ANALYSIS FOR PHASE & BALANCE, AND CURRENT ANALYSIS FOR RUSH / STARTUP, DEMODULATION, SIGNATURE ANALYSIS AND STATOR ECCENTRICITY.

Q2C Number: 34230952 **Quote Number:** 4 **Revision Number:** 0
Project Name: NORTH RIV PUMP STATION - 400HP VFD **Quote Name:** MATRIX DRIVES AND DIST EQUIP

ATTACHMENT 4: DRAFT BILL OF MATERIALS SCADA CONTRACT 4

Item No.	Qty.	Catalog Number / Details
013-00	1	**Designation:** PS Square D Custom Swbd Series 2 QED Switchboard (40 Working Days to ship ARO)
014-00	1	**Designation:** EDP ILINE ML PNLB (INT,BOX,FRT) I-Line Panelboard (30 Working Days to ship ARO)
015-00	1	**Designation:** P1 NF MB Panel (Interior) NF Panelboard (15 Working Days to ship ARO)
020-00	1	**Designation:** P1 MH50 (Box) NF Standard TYPE 1 Box 50 H (5 Working Days to ship ARO)
021-00	1	**Designation:** P1 NC50S (Trim) Trim Surface w/Door 50"H (15 Working Days to ship ARO)
016-00	1	**Designation:** HP NF MB Panel (Interior) NF Panelboard (15 Working Days to ship ARO)
022-00	1	**Designation:** HP MH62 (Box) NF Standard TYPE 1 Box 62 H (5 Working Days to ship ARO)
023-00	1	**Designation:** HP NC62S (Trim) Trim Surface w/Door 62"H (15 Working Days to ship ARO)
018-00	1	LOT OF STUDIES Coordination Study (6-8 Weeks to complete after receipt of all required information)
019-00	1	DAY OF START-UP AND TRAINING < Distribution Equipment> (3 weeks advanced notice to schedule)
024-00	1	TRNOSSAFARC01 NFPA 70E, CHAPTER 1 WORKSHOP (ARC FLASH) (6-8 weeks advanced notice to schedule)
025-00	3	DRIVES SYSTEM CENTER DSC 400HP, 460V, 3PH, 60Hz 481A, w/ Bypass (60 Working Days to ship ARO)
026-00	1	DRIVES SYSTEM CENTER Factory Witness Testing
027-00	3	DRVBURNIN8H40C Drive Burn In, 8 Hour
028-00	3	DRIVES SYSTEM CENTER Certified Test Reports

Q2C Number: 34230952 **Quote Number:** 4 **Revision Number:** 0
Project Name: NORTH RIV PUMP STATION - 400HP VFD **Quote Name:** MATRIX DRIVES AND DIST EQUIP

Item No.	Qty.	Catalog Number / Details
029-00	1	**Designation:** Spare Parts ATV61HC25N4D SPEEDDRIVE,400HP,460V,ATV61 NO CHOKE
030-00	1	**Designation:** Spare Parts VW3A1101 LCD GRAPHIC KEYPAD IP54 RATING ATV71
031-00	3	**Designation** Spare Parts LPJ600SP Class J 600A 600V Fuse (25423-36000)
032-00	2	**Designation:** Spare Parts 2543020281 FNQ-R-2-8/10 AMP FUSE
033-00	1	**Designation:** Spare Parts 2543020400 FUSE
034-00	1	**Designation:** Spare Parts 2550100003 MINI_BAYONET_LED_120V_RED
035-00	1	**Designation:** Spare Parts 2550100004 MINI BAYONET LED 120V YEL
036-00	1	**Designation:** Spare Parts 2550100005 MINI_BAYONET_LED_120V_GRN_
037-00	1	**Designation:** Spare Parts ZB5AV6 MOUNTING BASE W DIRECT SUPPLY LM
038-00	6	START-UP & PERFORMANCE TESTING (3 weeks advanced notice to schedule per trip)
039-00	1	VFD TRAINING (6-8 weeks advanced notice to schedule)
040-00	1	HARMONICS FIELD STUDY (6-8 Weeks to complete after collection of all required information)
041-00	1	**Designation:** T-P1 EE75T151HCT Transformer Dry Type 75kVA 480-240DCT (Stock to 15 Working Days to ship ARO)

EMERSON
Network Power

Address all Orders and Replies To :

ASCO Baltimore/Washington
12310 Pinecrest Rd
Suite 204
Reston, VA 20190
Fax.No:342-0391

JOB NAME & QUOTATION NO : HARRISONBURG & E5-14-100025-1-1

#1	ATS	AMPS : 0600	QTY : 1

Bulletin Number : 4000 Series Transfer Switches		Catalog Number :	J04NTSA30600N5XC,14AC,14BC,18Z2,72E
Service Voltage / Hz : 480V/60Hz		Optional Accessories :	14A/14B,18Z2,72E
By-pass Isolation : Not Applicable		Product Description :	Non-Automatic Transfer Switch
No. of Switched Poles : 3		Neutral Configuration :	Solid [A]
Withstand Rating A @ 480V : 200,000 (With Current Limiting Fuses), 50,000 (Specific Breaker), 35,000 (Any Breaker) Other Ratings May Apply. Contact ASCO For Details.		No. of Cables & Lug Size :	
Enclosure : 1(C)-Nema 1 enclosure		Service :	Three Phase, 4-wire
Extended Warranty (Years - Cost) : Not Included		Markings :	
		Extended Net Price : Product Only - Excludes Warranty, Start Up and Freight Adders	

ACCESSORIES DESCRIPTION

#	Accessory Code	Description
1	14AC,14BC	4 Aux Contacts Closed on Normal, 4 Aux Contacts Closed on Emergency
2	18Z2	Same as 18Z with additional control board to provide two sets of form C contacts (rated 2A@30vdc, 0.5A@125vac)
3	72E	Serial communication module and connectivity module for remote communications. Modbus RTU & ASCOBus

EMERSON
Network Power

Address all Orders and Replies To :

ASCO Baltimore/Washington
12310 Pinecrest Rd
Suite 204
Reston, VA 20190
Fax.No:342-0391

JOB NAME & QUOTATION NO : HARRISONBURG & E5-14-100025-1-1

#2	ATS	AMPS : 0600	QTY : 1

Bulletin Number	:	4000 Series Transfer Switches	Catalog Number	:	J04ATSA30600N5XC,14AC,14BC,18Z,72E
Service Voltage / Hz	:	480V/60Hz	Optional Accessories	:	14A/14B,18Z,72E
By-pass Isolation	:	Not Applicable	Product Description	:	Automatic Transfer Switch
No. of Switched Poles	:	3	Neutral Configuration	:	Solid [A]
Withstand Rating A @ 480V Other Ratings May Apply. Contact ASCO For Details.	:	200,000 (With Current Limiting Fuses), 50,000 (Specific Breaker), 35,000 (Any Breaker)	No. of Cables & Lug Size	:	2, #1/0 AWG to 600 MCM
Enclosure	:	1(C)-Nema 1 enclosure	Service	:	Three Phase, 4-wire
Extended Warranty (Years - Cost)	:	Not Included	Markings	:	
			Extended Net Price Product Only - Excludes Warranty, Start Up and Freight Adders	:	

ACCESSORIES DESCRIPTION

#	Accessory Code	Description
1	14AC,14BC	4 Aux Contacts Closed on Normal, 4 Aux Contacts Closed on Emergency
2	18Z	One form C contact (rated 2A@30vdc, 0.5A@125vac) for each normal and emergency source availability, plus one form C contact wired to feature 31 Group 5 controller output (see PDS-042 for feature 31 description), plus one programmable additional relay.
3	72E	Serial communication module and connectivity module for remote communications. Modbus RTU & ASCOBus

February 19, 2014

City of Harrisonburg
2155 Beery Drive
Harrisonburg, Virginia 22801

Attention: Mr. Mike Collins
Subject: **North River Pump Station Conversion**
Quote #012714

Dear Mike:

I am pleased to submit for your consideration our proposal for the following items:

Item	Quantity	Description
1	1	**RADIO Control Panel for NRPS as Follows:** Enclosure, NEMA 1, Steel, Wall Mount, 26"x 48"x 10" Power Supply/Charger Assembly, 120VAC/12 & 24 VDC Power Supply Mounting Plate One (1) Battery, lead Acid, 12 Volts, 5 ampere-hours One (1) Lot of Control wave Micro equipment as outlined in item 2 Radio Modem Transceiver, Spread Spectrum #MDS TransNET 900 With Diagnostic Software Radio Mounting Bracket RF Surge Protector RF Cable, Coaxial, RG-223, Radio to RF Surge Protector Radio Antenna, Yagi Directional, 6 db Gain, Maxrad #MTG9303-ED One (1) Co-Axial Jumper Cable 150 Feet, 5/8" Heliax Cable, with N Male & N Female Connectors Two (2) Antenna Grounding Kits AC Power Distribution Assembly DC Power Distribution Assembly Ground Fault Interrupter, Duplex, (GFI) Misc. Wire, Cable, DIN Rail, Connectors, etc. Relocate and rewire existing DPC3330 equipment from existing panel under this contract Documentation - Includes Assembly Drawing, & Internal Enclosure Wiring Diagram

Item	Quantity	Description
2	**1**	**Lot of Control Wave Micro equipment as follows:** Chassis Type(1) : 4I/O Slot panel mount rack Part Number : 396560-01-6 Chassis Type(1) : 8 I/O Slot panel mount expansion rack Part Number : 396560-01-6 Power Supply (1) : 24VDC w/display interface, no wet-end Part Number : 396657-01-0 CPU(1) : 4MB & 2-RS232, 1-RS485, 1-Ethernet Part Number : 396563-06-6 **Local Termination I/O Modules** Analog Input(4) : 8 AI, 4-20 mAdc Part Number : 396604-01-3 Analog Output(1) : 4 AO, 4-20 mAdc Part Number : 396604-01-3 Discrete Input(1) : 16 DI w/LED's (24Vdc input) Part Number : 396571-02-6 Discrete Output(1) : 16 DO w/LED's Part Number : 396572-02-2 Cover Plates (3) Part Number : 396545-01-7 LCD Display(1) : 25 Button Part Number : 396608-02-7
3	**1**	**Rosemount Pressure Transmitter (Station)** Range : 0 TO 300 PSIG Calibration : 0 TO 300 PSIG Output : 6 to 42 Vdc (4-20 Ma DC) Diaphragm & Conn : 316 SS Housing : Low copper alum-Nema IV Indication : LCD Model Number : 2088G2S22A1M4D4T1Q4
4	**1**	**Rosemount Temperature Transmitter (Station)**
5	**1**	**Hach Turbidity Transmitter**

Item	Quantity	Description
6	1	**Lot of Engineering, Start Up and Training Service as Follows:** Provide wiring, testing and system configuration for the NRPS panel. New Control Wave Micro equipment will be installed under this contract, along with converting the communications system from telephone to radio. We will reconfigure Scada system to reflect changes from Modem to Radio communications. Modify Network Architecture and RTU Software to accommodate changes. Modify WTP1, WTP2 and WOC computers for above additions. See details outlined below**.**

Mike, I have included the following as part of the Engineering services as listed in item 6:

1. Complete set of submittals (5 copies) including all components and panel drawings.

2. Engineering and programming services to convert existing ACCOL program from Bridgewater Pump Station to Control Wave Designer. This will include the addition and implementation of the VFD's into the program. Additionally we will provide a detailed program description and test procedure.

3. Reconfiguration of all Genesis systems at the Plant and the Water Operations Center.

4. All terminations and field wiring associated with the SCADA control panel.

5. On Site start up of each of the VFD's (three days per drive), as well as phone availability during each drive's test cycle. We will also maintain both the old and the new control systems during the start up phase of this project.

6. On Site training for City personnel regarding the programming and operation of the new pump station.

The installation of the coax cable and antenna is not included in my proposal. I assume that City personnel or other contractors can perform this work. I have included the labor to wire the radio panel once they are installed. Please let me know if you have any questions and/or concerns you would like to discuss.

The following notes apply to all sections quoted above:

1. All training and start up are included as noted above.

2. All submittals and system design information will be provided within eight (6) weeks of receipt of purchase order.

3. All equipment outlined above will be provided to and installed by the General Contractor and/or city of Harrisonburg personnel.

4. All wiring and terminations to the field devices shall be provided and done by the Electrical Contractor. All wiring in the control panel shall be run by the electrical contractor and tagged and identified. All terminations in the control panel shall be made by Interface, Inc.

5. All application software shall be done in accordance with the City of Harrisonburg standard practices and requirements.

Should you have any questions, concerns that you would like to discuss, please call or email to let us know. Thank you for the opportunity to quote on your requirements.

North River Pump Station SCADA Needs Assessment - I/O Points Schedule: Control Wave Conversion						
Item #	**Description**	**Digital Into C. Wave**	**Digital Out**	**Analog Into C. Wave**	**Analog Out**	**Sensor**
		FROM NRPS	**FROM NRPS**	**FROM NRPS**	**FROM NRPS**	**Location**
1	Motor 1 Upper Bearing Temperature			1		Integral to Motor
2	Motor 2 Upper Bearing Temperature			1		Integral to Motor
3	Motor 3 Upper Bearing Temperature			1		Integral to Motor
4	Motor 1 Oil Reservoir Low Level Alarm			1		GC Mount to Reservoir
5	Motor 2 Oil Reservoir Low Level Alarm			1		GC Mount to Reservoir
6	Motor 3 Oil Reservoir Low Level Alarm			1		GC Mount to Reservoir
7	Motor 1 Lower Axis Vibration Sensor			1		GC Mount to Motor
8	Motor 1 Lower Axis 90-degree Vibration Sensor			1		GC Mount to Motor
9	Motor 2 Lower Axis Vibration Sensor			1		GC Mount to Motor
10	Motor 2 Lower Axis 90-degree Vibration Sensor			1		GC Mount to Motor
11	Motor 3 Lower Axis Vibration Sensor			1		GC Mount to Motor
12	Motor 3 Lower Axis 90-degree Vibration Sensor			1		GC Mount to Motor
13	VFD 1 I/O Control and Monitoring (VIA PLC)	1	2 (run/stop)	1	1 (Speed Mod.)	1 (Speed Mod.)
14	VFD 2 I/O Control and Monitoring (VIA PLC)	1	2 (run/stop)	1	1 (Speed Mod.)	1 (Speed Mod.)
15	VFD 3 I/O Control and Monitoring (VIA PLC)	1	2 (run/stop)	1	1 (Speed Mod.)	1 (Speed Mod.)
16	Motor 1 Amp Monitoring			1		Integral to VFD
17	Motor 2 Amp Monitoring			1		Integral to VFD
18	Motor 3 Amp Monitoring			1		Integral to VFD
19	Motor 1 kW Monitoring			1		Integral to VFD
20	Motor 2 kW Monitoring			1		Integral to VFD
21	Motor 3 kW Monitoring			1		Integral to VFD
22	Motor 1 PhaseVoltage Monitoring			1		Integral to VFD
23	Motor 2 Phase Voltage Monitoring			1		Integral to VFD
24	Motor 3 Phase Voltage Monitoring			1		Integral to VFD
25	Power Failure Confirmation	1				Signal from VFD
26	Manual Remote Start Pump 1 on Gen	Programing in CPU				
27	Manual Remote Start Pump 2 on Gen	Programing in CPU				
28	Ambient Room Noise Monitoring			1		GC Mount
29	Ambient Room Temperature Monitoring			1		GC Mount
30	Clearwell Turbidity Monitor			1		GC Mount
31	CCTV Video Interlink	Separate Fiber Connection or Telemetry System				
32	Discharge Pressure			1		Existing

DEPARTMENT OF FINANCE AND PURCHASING

345 South Main Street

Harrisonburg, VA 22801

ISSUE DATE: Feb 3, 2014	**REQUEST FOR PROPOSAL NUMBER:** **2014028-PU-P**	**FOR:** North River Pump Station Motor Replacement
DEPARTMENT: Public Utilities	**DATE/TIME OF CLOSING:** February 20, 2014 @ 2:00 pm local time	**CONTRACT ADMINISTRATOR:** Mike Collins, Public Utilities Director

Proposals - In accordance with the following and in compliance with all terms and conditions, unless otherwise noted, the undersigned offers and agrees, if the proposal is accepted, to furnish items or services for which prices are quoted, delivered, or furnished to designated points within the time specified. It is understood and agreed that with respect to all terms and conditions accepted by the City of Harrisonburg the items or services offered and accompanying attachments shall constitute a contract.

NAME AND ADDRESS OF FIRM:

Telephone/Fax No.:

Federal Employer Identification # :

State Corporation Commission #:

E-mail:

Prompt Payment Discount: __% for payment within___days/net___ days

By signing this proposal, Vendor(s) certifies, acknowledges, understands, and agrees to be bound by the conditions set forth in this RFP.

CHECK ONE: ☐ INDIVIDUAL ☐ PARTNERSHIP ☐ CORPORATION ☐ LLC

Vendor's Legally Authorized Signature

Date

Print Name

Title

Sealed proposals, subject to terms and conditions of this Request for Proposal will be received by the City of Harrisonburg Purchasing Agent at 345 South Main St, Room 201, Harrisonburg, Virginia 22801 until the date/ time specified above for furnishing items or services delivered or furnished to specified destinations within the time specified or stipulated by the vendor(s).

The City does not discriminate against small and minority businesses or faith-based organizations.

CITY OF HARRISONBURG
DEPARTMENT OF FINANCE AND PURCHASING
AND THE DEPARTMENT OF PUBLIC UTILITIES
REQUEST FOR PROPOSAL:

RFP NO. 2014028-PU-P
NORTH RIVER PUMP STATION UPGRADE 2013
PROJECT 473-12-13
CONTRACT 3 FOR MOTOR REPLACEMENT

TECHNICAL SPECIFICATION
REVISED: FEBRUARY 3, 2014

TABLE OF CONTENTS

ATTACHMENTS:

A1 - RECORD INSTALLATION DATA - EXISTING NORTH RIVER PUMP STATION MOTORS AND PUMPS

A2 - IDENTIFICATION OF PROPRIETARY/CONFIDENTIAL INFORMATION

A3 - VIRGINIA STATE CORPORATION COMMISSION FORM

A4 - CITY OF HARRISONBURG STANDARD CONTRACT TERMS AND CONDITIONS

A5 - SAMPLE CONTRACT

1. PURPOSE

The City of Harrisonburg Department of Public Utilities (DPU) is requesting proposals, subject to the specifications and conditions contained herein, to provide three replacement, vertical hollow-shaft, premium efficiency, 400 horsepower, inverter-duty rated (VFD rated) motors suitable for installation on the existing vertical turbine pumps at the North River Pump Station in Bridgewater, Virginia.

This solicitation, and the resulting agreement, shall be consistent with the the Virginia Public Procurement Act (VPPA) and the City of Harrisonburg's Purchasing and Contracting Policy Manual. This Request for Proposal (RFP) is being utilized in lieu of an Invitation for Bid (IFB) due to the specialized nature of the electrical equipment required within this pump station that has specific standardization needs in order to be compatible with existing equipment within the pump station and new variable-frequency motor drives that are being procured concurrent to this solicitation.

2. BACKGROUND INFORMATION

The DPU is responsible for providing water and sewer services to residences and businesses in the City of Harrisonburg and in portions of neighboring Rockingham County. The North River Pump Station is a key component of the raw water system operated by the DPU.

The North River Pump Station (NRPS) is located at 699 E Riverside Drive, Bridgewater, VA 22812. The NRPS pumps raw water from the North River to the Grandview Drive Water Treatment Plant and has a rated design capacity of 5,300 gallons per minute (GPM) using using three existing 350 hp motors. Replacement 400 hp motors procured under this solicitation shall be delivered to the DPU Water Operations Center, Central Stores at 2111 Beery Road, Harrisonburg, Virginia.

3. SCOPE OF SERVICES

A. The DPU will evaluate, select and directly purchase from one (1) Manufacturer (Provider); three (3) 400 HP, 480V, 3 PH, 60Hz premium-efficiency, vertical hollow-shaft motors (Equipment); with an additive alternate option to buy a fourth identical motor to be delivered within six months of base purchase. All motors shall meet the Equipment requirements contained in this Request for Proposal (RFP).

B. The Equipment procured under this RFP will be fitted to existing pumps as City furnished, contractor installed material as part of the City's NRPS Improvements Project and that installation effort will be independent of this solicitation. Installation of these motors will be conducted by an independent general contractor (Installing Contractor), that will be responsible for reconfiguring the NRPS for operation of the new motors on a new 480V power supply. The motors specified herein shall be designed for continuous duty operation using 480V Variable Frequency Drives (VFDs) and shall include features required for the full range of variable speed operation. Motor features shall include components that prevent damage to bearings, core, windings and other motor elements from mechanical loads, VFD induced shaft currents, winding loads, thermal effects, electrical pulses, electrical and mechanical harmonics in accordance with current NEMA MG1 standards.

C. The NRPS Improvements Project will be executed under four contracts as follows:

i. Contract 1: Install Contract;

ii. Contract 2: VFD Provider;

iii. Contract 3: Motor Provider; (this solicitation)

iv Contract 4: SCADA Provider

Contract 1, (Install Contract), includes sequenced conversion of three existing 2300 V vertical turbine pump motors to 480V operation and VFD control by the installing contractor, with VFDs provided on Contract 2 (VFD Provider). The 480V motors provided under this solicitation, Contract 3, (Motor Provider) will be sequentially installed on each pump follow terms of this contract. Each motor and pump assembly will subject to a 7-14 day commissioning period by the installing contractor in cooperation with and fully supported by, the VFD Provider and Motor Provider (Contracts 2 and 3) prior to initiating work on the next pump, (four week commissioning period total). Specifications are provided specific to each contract and a full set of construction documents will be provided for the project.

4. SPECIFICATIONS

A. The Provider shall furnish and provide manufacturer support required for factory certified installation of: three, 400 hp, 480V, 3 PH, 60Hz, Premium Efficiency, Inverter Duty Rated, Vertical Hollow-Shaft motors rated for continuous motor operation in a non-climate controlled environment (Equipment). All Equipment shall meet the functional and performance requirements contained in this RFP. ***Any exceptions noted to these specifications must be highlighted in the Provider's technical submittal narrative.***

B. The Provider shall be responsible for issuing a Certificate of Proper Installation and a Certificate of Proper Operation for the Equipment in conjunction with the Installing Contractor contract.

C. Existing Vertical Turbine Pumps

i. The Provider shall be responsible for coordinating the Equipment with the existing vertical turbine pumps as described in this RFP. Original installation drawings and documentation of current equipment installations are attached hereto. On-site inspection to verify installation requirements is mandatory and shall be coordinated with the City as described herein.

ii. Provider installation coordination shall include identifying and supplying adapter coupling (if required) between the existing pump head, (which was designed based upon a medium voltage, 2300V motor frame) and the proposed motor frame; any pump head or mounting frame modifications required for installation of proposed motors shall be provided as part of Equipment by the Provider.

D. The following Motor Manufacturers will be considered as basis-of-design Equipment requirement; alternate motors meeting these performance specifications may be considered, but the City reserves the right to select motors based on technical need and system unity standards:

i. US Motors

ii. General Electric Motors

iii. Aurora Motors

iv. TECO/Westinghouse

E. Equipment Provider shall be responsible for coordinating with the Installing Contractor as DPU's manufacturer's agent; the Equipment shall be installed by the Installing Contractor under the direction of the Provider's manufacturer's certified field representative (Field Representative). It is projected that this installation will occur between April and July, 2014; the Installing Contractor has not been selected at this time.

F. All electrical connections that are not factory assembled and shipped complete shall only require the Installing Contractor to connect wires between junction boxes installed on the Equipment by the provider. The 3-phase power connection for the motor shall be made directly to the removable electrical termination box (conduit box) mounted on the motor as part of Equipment. Equipment mounted conduit box shall be sized to accommodate wiring with aluminum conductors sized based up maximum motor load including service factor (full load amps). The Installing Contractor shall utilize a separate NEMA 4X rated electrical box to terminate, connect and identify all 120V circuits required for Equipment operation. Equipment Provider shall provide separate shielded and grounded wiring connections for all low voltage power and controls as part of Equipment. Motor assembly shall be designed to fit through existing pump station roof hatches that have a maximum clear rectangular opening of 3'-6" x 4'-0". Motors shall be equipped with lifting lugs suitable for installation and removal by crane through said opening.

G. All instruments and electrical connections required to make a fully functioning and complete system that meets the functional and performance requirements of the RFP that are not shipped integral to or mounted on the motor shall be supplied (but not installed) by the Provider. All electrical connections that are not factory assembled and shipped complete shall only require the Installing Contractor to connect wires between junction boxes installed on the Equipment supplied by the Provider. Full wiring diagrams shall be provided for all required motor and control connections.

H. Performance Specifications: Equipment shall meet the following minimum design parameters in addition to matching existing pump installation configuration. ***Note any exceptions or additional recommended features required to meet motor performance objectives in the Provider's technical narrative submittal:***

Design Parameter	Equipment
Number of Units	3
Motor Size	400 hp
Frame Size	Per MFR Recommendation
Efficiency Class	Premium
Minimum Efficiency at FLA	96.2%
Rated Service Temperatures	40 C
Service Factor w/o VFD Operation	1.15
Insulation	Class F or G
Enclosure	WP1
Electrical Power	460V/3PH/60Hz
Minimum Down-Thrust Rating	13,500 lbs
Oversized Main Conduit Box	Yes
Jacking Alignment Screw Taps	Yes
Inverter Duty	Yes
Oil Cooled Thrust Bearing	Yes
Insulated Bearings	Yes
Shaft Grounding Ring	Yes
Frame Grounding Terminal	Yes
Non-Reverse Ratchet	Yes
Integral Heaters (115V)	Yes
Stator Winding RTDs w/local controller	Yes (2 per Phase/ 100 Ohm)
Thermistors w/ local controller	Yes
Thermostats w/ local controller	Yes
Bearing RTDs w/ local controller	Yes (2 per motor)
Vibration Sensors	Yes
Stainless Steel Hardware	Yes
Noise Reduction (>85 db @1 m)	Yes
Factory Blue Epoxy Paint	Yes

I. Vibration Analysis

i. The selected Provider shall evaluate and configure Equipment to minimize and eliminate harmful vibrations and harmonics due to conversion of the existing constant speed pumps to VFD control as detailed below. This shall include provision of specific three-axis in-place testing report documenting in-place vibration performance of each motor provided on this solicitation, including full range of anticipated continuous-duty motor speed operation ranging between 1,250 RPM to 1,800 RPM.

a. The Provider shall perform a Reed Critical Frequency (RCF) analysis in accordance with Hydraulic Institute Standards at the factory via bump test on each motor to determine the RCF of each specific motor supplied on this contract by the Provider and provide results of this testing with motor certifications.

b. The Provider shall provide an interference diagram predicting pump speeds that will be subject to interference/vibration based on finite element analysis of the resonant and excitation (critical) frequencies of the new motors. This analysis shall include evaluation of the new motor installation on existing pumps, pump pedestals and frames. Utilize measured RCF of each motor and pump stiffness/rigidity based on installed condition of the existing pumps and pump pedestals to design any required Equipment reinforcing in accordance with Hydraulic Institute Standards.

c. If the vibration analysis predicts resonant frequency problems within the pump station for specified operating range of the pumps, provide specific recommendations and Equipment appurtenances to minimize or eliminate the interferences. Recommendations may include but are not limited to stiffening the existing base or adding mass to the motors to alter the resonant frequencies. Tuning out critical frequencies will not be considered an acceptable method of vibration control for this installation.

d. Provide three integral vibration sensors mounted to motor frame at three separate locations (3-axis monitoring) to provide continuous real-time monitoring of installed motor operation with 4-20 mA output leads and local controllers mounted externally to the motor enclosure for SCADA system integration as part of Equipment for connection by Installing Contractor.

J. Equipment Enclosure, Fan, Frame, Shaft and Bearing Isolation

i. Motor enclosure shall be rated for WP1.

ii. Provide continuous contact, field serviceable, shaft grounding ring rated for life of bearings as part of Equipment. Equipment shall also include ceramically insulated raceway mounts to prevent circulating shaft bearing currents at both the thrust bearing and alignment bearing on the motor Equipment. Ceramic coating shall provide a uniform surface with a Rockwell Hardness of 50C, and shall provide a minimum electrical resistance of 1.0 gigoOhm or greater at 1,000 Volts. Electrical impedance within motor wiring shall be consistent and

coordinated to minimize internal reflectance; factory certified internal impedance shall be specifically listed for each for coordination with Installing Contractor. Shaft current protection device shall meet IEEE standard for Application of Static Charge Dissipation to Mitigate Electric Discharge Bearing Currents and performance shall be verified in the field using harmonic voltage meter to fully capture all potential order harmonic shaft currents, oscilloscope meter verification will be required during installation.

K. Motor Equipment Bearings:

i. Thrust bearings shall be rated for a minimum working down thrust of 13,500 pounds. Provide preloaded springs to provide minimum down-thrust and prevent bearing skidding. Bearing frames shall have integral oil-cooling configuration suitable for connection to externally mounted oil filled heat exchanger (provided by others). Temperature sensor and level indicator on bearing oil reservoir shall be installed by others.

ii. Provide factory mounted non-reverse ratchet mechanism to positively engage shaft and prevent pump reversal upon motor shutdown. Ratchet mechanism shall be suitable for variable speed operation and shall fully disengage upon motor start-up and operation.

iii. Provide stator winding RTDs (2 per Phase/ 100 Ohm) and bearing RTDs (2 per motor) with local controllers mounted externally to the motor enclosure to monitor bearing temperature at thrust and lower bearings. Local controllers shall output a digital high temperature alarm.

iv. sequence.

v. All bearings shall conform to the standards of the Anti-Friction Bearing Manufacturers Association, Inc. (AFBMA). Bearings shall have a minimum L-10 life expectancy of 100,000 service hours.

L. Factory Finishing

i. Shop prepare, prime, and finish coat all ferrous metal components of the Equipment in accordance with the following schedule for Exposed Metal - Corrosive Environments. DPU to select finish coat colour as part of shop drawing review and approval process.

Surface Prep.	Paint Material	Min. Coats, Cover
SSPC – SP10	Epoxy Primer – Ferrous Metal	1 coat, 2.5 MDFT
	High Build Epoxy	1 coat, 4 MDFT
	Polyurethane Enamel	1 coat, 3 MDFT

M. General Requirements

i. Safety Devices: The Equipment shall include all necessary permanent safety devices, such as machinery guards, emergency stops, non-ratcheting returns and similar items required by OSHA, and other federal, state, and local health and safety regulations.

ii. Flanges and Pipe Threads: Threaded flanges and fittings shall have standard taper pipe threads complying with ANSI/ASME B1.20.1.

iii. Provide lifting lugs for all Equipment components weighing over 100 pounds.

iv. The Equipment shall comply with all applicable federal, state and local codes and regulations to include safety and fire codes and regulations.

N. Warranty Requirements

The Provider shall provide a full written warranty for all equipment provided under this RFP. The warranty period shall be 24 months from start-up but not to exceed 30 months after the date of Substantial Completion. If a defect is found during the warranty period, the Provider shall remedy said defect at no cost to DPU. The Provider shall provide a cost adder for extending the warranty for all equipment to 36 months from start-up but not to exceed 48 months after the date of Substantial Completion. Warranty coverage shall extend to protect against any VFD-induced motor or bearing damage for the life of the motor.

O. Shop Testing

i. Prior to shipment of the equipment the motors shall be run tested to confirm RFC.

ii. Provide Vibration Analysis Report before submitting Certificate of Proper Installation.

iii. During the shop test the following parameters shall be recorded:

a. Motor serial number, frame designation, testing agent name, certification number and location, date and time of test. DPU shall be notified 5-days in advance of certification testing and shall be permitted unimpeded access to attend and witness factory certification testing at the manufacturer's test site. Travel cost for DPU to observe test shall be independent of Equipment cost and shall be borne by DPU.

b. Certified shop test report s shall be submitted to DPU with delivery of each motor.

P. Field Testing

i. Provider shall conduct functional and performance field tests of the Equipment to determine systems ability to operate within the performance limits specified. The Provider shall coordinate with and direct the Installing Contractor during motor installation and shall be responsible for issuing a Certificate of Proper Installation and a Certificate of Proper Operation for the Equipment.

ii. Provider shall include a minimum of six days of on-site installation support with Field Representative present on site full time for 8-hours each day; (minimum of four separate visits required); additional days may be provided at Provider's discretion.

iii. Functional Test

a. Provider shall issue a Certificate of Proper Installation for each motor prior to start up.

b. Field test all equipment components for proper alignment and connection. Test complete drive assemblies for correct rotation, proper alignment and connection, and quiet, trouble-free operation.

c. Make all adjustments necessary to place equipment in specified and working order at the time of above tests without preload, overstress or improper alignment.

iv. Performance Test

a. Motor No. 1 for Pump No. 1 shall be operated for a continuous 14 day period. Upon Owner acceptance of the motor, the Provider shall issue a Certificate of Proper Operation for Motor No. 1.

b. Following issuance of the Certificate of Proper Operation for Motor No. 1, Motor No. 2 will be installed by the Installing Contractor and a Functional Test completed. Motor No. 2 for Pump No. 2 shall be operated for a continuous 7 day period. Upon Owner acceptance of the motor, the Provider shall issue a Certificate of Proper Operation for Motor No. 2.

c. Following issuance of the Certificate of Proper Operation for Motor No. 2, Motor No. 3 will be installed by the Installing Contractor and a Functional Test completed. Motor No. 3 for Pump No. 3 shall be operated for a continuous 7 day period. Upon Owner acceptance of the motor, the Provider shall issue a Certificate of Proper Operation for Motor No. 3.

d. Providers Field Representative shall be present at the site for at least 8 hours to direct Functional Testing and Performance Testing for each motor start-up (minimum total of 24 hours of base field time specified). The same Field Representative shall be available to return to the site within 24 hours if Performance Testing is interrupted for any reason. If Performance Testing is interrupted due to defective equipment within the scope of supply of the Provider, the Field Representative shall be present at no additional cost to Owner. If Performance Testing is interrupted due to defective equipment outside the scope of supply of the Provider, the Field Representative shall be present at a daily rate as listed in proposal (at DPU expense).

v. Promptly correct or replace all defective equipment within the scope of supply of the Provider revealed by or noted during tests at no additional cost to the DPU and repeat tests until specified results acceptable to DPU are obtained.

vi. Field testing shall be directed by the Providers Field Technician.

Q. Certificates

i. A Certificate of Proper Installation for the Equipment shall be issued to and accepted by the DPU by the Provider prior to any operation or field testing of the equipment.

ii. A Certificate of Proper Operation for the Equipment shall be issued to and accepted by the DPU by the Provider in coordination with Installing Contractor.

iii. DPU acceptance of both certificates shall be a prerequisite condition for Provider to request a substantial completion inspection for final payment.

R. Training

i. The same Field Technician that directed field testing shall provide at least 4 hours of training to DPU staff with regard to: (1) operation; (2) routine maintenance; and (3) preventative maintenance procedures on the Equipment. The DPU will establish date and classroom location during which required training shall be delivered.

S. General Equipment Requirements

i. Material and equipment shall be provided that is:

a. Constructed and finished in a workmanlike manner.

b. Suitable for the purpose intended, especially as related to acceptability for use in a raw water pumping facility.

c. Selected and fabricated to the best engineering practice.

d. Mechanical and electrical equipment, particularly bearings, contacts and other wearing parts shall be designed for extended periods of operation without frequent maintenance or attention.

e. Motors and drives shall be furnished with safety devices including shear pins, flexible coupling guards and belt guards.

f. All machinery shall be designed such that all working parts are readily accessible for inspection and repair, and each part is suitable for the service required.

g. An adequate and, as far as practicable, automatic means of lubrication for all working parts shall be provided. Arrange lubrication grease nipples, grease boxes and other lubrication devices so that they are readily accessible for routine greasing. Use grease nipples of a consistent type; alemite button head type or equivalent. All lubricating products are to be selected based on used in public water supply applications.

ii. Flanges and pipe threads:

a. All pipe flanges shall conform in dimension and drilling to ANSI B16.1, Class 250 (cast iron pipe) and to ANSI B16.42, Class 300 (ductile iron pipe),unless otherwise specified.

b. Provide like flanges for all connections. The connection of dissimilar flanges will not be accepted.

c. Pipe threads shall conform to ANSI B1.1, coarse thread series, Class 2 fit.

d. Flange assembly bolts shall be heavy pattern, hexagonal head, stainless steel machine bolts with heavy pattern hexagonal nuts conforming to ANSI B18.2.1 and B18.2.2.

e. Bolt threads shall conform to Unified Screw Threads, Standard Coarse Thread Series, Class 2A and 2B, ANSI B1.1.

iii. Bearings

a. Unless otherwise specified, oil or grease lubricated ball or roller type equipment bearings shall be designed to withstand the stresses of the service conditions specified. Rate each bearing in accordance with AFBMA Methods of Evaluating Load Ratings of Ball and Roller Bearings.

b. Equipment bearings shall have a minimum B-10 rating life of 100,000 hours, as determined using the maximum equipment operating speed, unless otherwise specified.

c. Grease lubricated bearings, unless factory sealed and lubricated, shall be furnished with easily accessible grease supply, flush, drain, and relief fittings. Use extension tubes where necessary. Provide standard hydraulic alemite type grease supply fittings.

iv. Guards

a. Sheet-expanded guards, or equal are to be furnished on all mechanical moving parts in accordance with workplace safety regulations.

b. Guards shall be fabricated of 14 gauge steel, or equal, and painted red after fabrication to same standard as parent equipment.

c. Guards are to be removable to facilitate maintenance of moving parts.

d. Provisions are to be made to extend lube fittings through guards.

v. Caution signs

a. Provide signage in accordance with OSHA standards and requirements:

1. All rotating equipment drives shall be identified with caution signs.

2. Caution signs shall consist of vinyl stick-on type decals positioned immediately adjacent to the rotating element and placed onto a clean, smooth surface.

3. When an insufficient space or surface exists the decal is to be applied to a galvanized mild steel, fiberglass, or plastic sheet fastened to equipment.

4. The caution signs shall read "CAUTION - AUTOMATIC EQUIPMENT MAY START AT ANY TIME".

5. Sign letters are to be 25 mm in height, in red, on a yellow background.

vi. Pilot devices

a. For electrical pilot devices including switches, relays, and contacts, heavy-duty industrial quality devices are to be furnished.

b. Contacts which provide alarm malfunction or control to external systems are to be rated for 10 amp continuous service at 120 volts AC. Pressure and temperature switches are to be rated for 5 amp continuous service at 120 volts AC.

vii. Indicating lights

a. Oil-tight transformer type indicating lights with LED lamps are to be furnished.

T. Submittals: The following additional information shall be provided in the Provider's Technical Submission as part of this initial proposal response:

i. Motor data sheet to include nameplate data, performance data, dimensional data, wiring diagram, reed frequency analysis, and performance curves indicating rotating speed, amps, efficiency plotted against horsepower; torque and amps plotted against rotating speed; acceleration time plotted against percent full load current.

ii. Provide mechanical drawings of all equipment to include custom couplings and optional equipment.

iii. Provide an itemized list of all equipment (including fans, instruments, etc.) that comprise the Equipment and provide cut sheet information sufficient to ensure compliance with the technical requirements of the RFP.

iv. Provide an itemized list of alternate equipment that can be offered with add or deduct pricing.

v. The proposal shall be based upon the Equipment as set forth herein, however alternate Equipment with additive or deductive pricing can also be included at the Provider's discretion.

vi. Provide itemized maintenance schedule based on motor run time and calendar days for recommended operations and maintenance activities.

vii. Provide a separate daily rate for the Provider's Field Technician to be on site. This rate shall be in effect throughout the duration of the project and for 12 months following Substantial Completion.

viii. Provide 3 hard copies of the Operations and Maintenance Manual for the Equipment and an electronic copy in portable document format (PDF).

5. GENERAL CONTRACT CONDITIONS

A. Precedence of Terms: In the event there is a conflict between the general contract conditions and any special terms and conditions which may be included in this solicitation for use in a particular procurement, the special terms and conditions shall apply.

B. Valid Contract: The extent and character of the services to be performed by the Provider shall be subject to the general control and approval of DPU Director, or his authorized representative. Any change to the Contract must be approved in writing by the DPU Director and the Provider.

C. Changes, Additions, Deletions: No changes, additions, deletions or substitutions of Contract Terms and Conditions, Specifications, Quantity, Unit of Issue, Delivery Date, Delivery Charges, or Price will be permitted without the written approval of the DPU Director.

D. Debarment Status: By submitting their proposals, Providers certify that they are not currently debarred by the Commonwealth of Virginia from submitting bids on contracts for the type of goods and/or services covered by this solicitation, nor are they an agent of any person or entity that is currently so debarred.

E. Antitrust: By entering into a contract, the Provider conveys, sells, assigns and transfers to DPU all rights, title and interest in and to all causes of action it may now have or hereafter acquire under the antitrust laws of the United States of America and the Commonwealth of Virginia, relating to the particular goods or services purchased or acquired by DPU under said contract.

F. Insurance: The Provider shall provide and maintain the following minimum limits of insurance coverage during the period of performance required under this Contract.

1) Comprehensive General Liability

   a. $1,000,000 Bodily Injury and Property Damage per occurrence and aggregate

   b. Comprehensive General Form

   c. Extended Business Liability Endorsement

   d. Independent Contractors Coverage

   e. Products/Completed Operations (to be provided for a minimum of 36 months after completion of the work)

   f. Broad Form Contractual Liability

   g. Personal Injury Liability

2) Comprehensive Automobile Liability

   a. $1,000,000 Combined Single Limits

   b. Statutory Uninsured Motorist Coverage

   c. Hired and Non-owned Coverage

   d. Motor Carrier Act Endorsement

3) Workers Compensation and Employer's Liability

   a. Statutory Coverage for Virginia

   b. $1,000,000 Employer's Liability

   c. Broad Form All States Endorsement

   d. Compliance with all Federal Statutes, including U.S. Longshoreman and Harbor Worker's Act, the Jones Act, and Federal Employees Act.

4) Umbrella Liability

   1) Additional $1,000,000 liability coverage over the primary limits for Comprehensive General Liability, Comprehensive Automobile Liability and the Employer's Liability

Prior to commencing work under the Contract, the successful Provider shall furnish DPU with a Certificate of Insurance naming DPU as an additional insured endorsed by insurance company licensed to provide insurance services in the Commonwealth of Virginia.

G. SCC Licensing: Corporations conducting business within the Commonwealth of Virginia must be incorporated in the Commonwealth of Virginia or present certification as issued by the Virginia State Corporation Commission and shall complete the attached SCC certification form and submit it with the proposal (See Attachment A3).

H. Hold Harmless Clause: The Provider shall, during the term of the Contract including any warranty period, indemnify, defend, and hold harmless DPU, its officials, employees, agents, and representatives thereof from all suits, actions, or claims of any kind, including attorney's fees, brought on account of any personal injuries, damages, or violations of rights, sustained by any person or property in consequence of any neglect in safeguarding contract work or on account of any act or omission by the Provider or his/her employees, or from any claims or amounts arising from violation of any law, bylaw, ordinance, regulation or decree. The Provider agrees that this clause shall include claims involving infringement of patent or copyright.

I. Employees Not to Benefit: As a prerequisite for payment pursuant to the terms of this Contract, there shall be furnished to DPU a statement that no employee of DPU, or members of the immediate family, including spouse, parents or children has received or has been promised, directly or indirectly, any financial benefit by way of fee, commission, finder's fee or in any other manner, remuneration arising from or directly or indirectly related to this Contract.

J. Public Inspection of Procurement Records: Proposals submitted shall be subject to public inspection in accordance with *Virginia Code* §2.2-4342.

K. Proprietary Information: Bids or proposals containing trade secrets or proprietary information submitted by a bidder, Provider, offeror or contractor in connection with a procurement transaction shall not be subject to public disclosure under the Virginia Freedom of information Act; however, the bidder, Provider, offeror or contractor must invoke the protection of this section prior to or upon submission of the data or other materials, and must identify the data or other materials to be protected and state the reasons why protection is necessary for each

section. Claim of trade secrets or proprietary information for the entire bid is not permissible, (See Attachment A2).

L. Samples: Samples, when required in the specifications, shall be delivered to the Executive Director at the Provider's/offeror's/bidder's expense by the date and time specified in the bid documents; said time is in no case shall be later than the bid opening. Samples shall be removed by the Provider/offeror/bidder at his/her own expense within 30 (thirty) days after written notice to do so. Failure to do so may result in storage of the property at the Provider's/offeror's/bidder's risk and expense, or declaration as abandoned property and subject to disposal as such.

M. Brand Names/Catalog References: Any catalog, brand name, or manufacturer's reference used in bid invitation is descriptive, not restrictive and shall be deemed to indicate " or approved equal" whether or not so state, unless justification by reason of sole source or emergency condition (e.g. repair parts, etc.) is specifically cited. Proposals/Bids on brands of like nature and quality will be considered, provided the Provider/offeror/ bidder submits a complete description of same and notes any and all reference numbers. Otherwise, it shall be understood that the specified brand will be furnished. Equality of the like nature items shall be determined by DPU. In such instances, the judgment of DPU is final. Exception to this "or approved equal" clause will be made if the bid calls for prequalification of products. In this case, only those brands and models cited in the bid documents, or those otherwise pre-qualified as set forth in said document, will be considered.

N. Ownership of Material: Ownership of all data, material and documentation originated and prepared for DPU, including any electronic media, shall belong exclusively to DPU and be subject to public inspection in accordance with the Virginia Freedom of Information Act.

O. Applicable Laws and Courts: This solicitation and any resulting contract shall be governed in all respects by the laws of the Commonwealth of Virginia and any litigation with respect thereto shall be brought in the Courts of Rockingham County, Virginia. The Provider shall be in compliance with all of the laws of the Commonwealth of Virginia, all ordinances and laws of Rockingham County and such other standards, codes, and regulations having application to the goods or services provided.

P. Exemption from Taxes: DPU is exempt from State and Federal Taxes. A Tax Exemption Certificate indicating DPU's tax exempt status will be furnished upon request.

Q. Substitutions: No substitutions, including key personnel or cancellations are permitted after Contract award without the written approval of the DPU Director.

R. New Goods, Fresh Stock: Unless otherwise specifically stated, the Provider shall provide new rather than used goods, fresh stock and the latest model, version, design or pack of any item specified.

S. Price Currency: Unless stated otherwise in the solicitation, Providers/offerers/bidders shall state prices in US dollars.

T. Assignment of Contract: This Contract may not be assigned in whole or in part without the written consent of the DPU Director as outlined in the City's General Contract Terms and Conditions.

U. Default: In case of failure to deliver goods or services, the City's General Contract Terms and Conditions shall be applied.

V. Termination: Subject to the provisions below, the Contract may be terminated by DPU upon sixty (60) days advance written notice to the other party; but if any work or service hereunder is in progress, but not completed as of the date of termination, then this Contract may be extended upon written approval of DPU until said work or services are completed and accepted.

W. Termination for Convenience: In the event that this Contract is terminated or canceled upon request and for the convenience of DPU, without the required sixty (60) days advance notice, then DPU shall negotiate reasonable termination costs, if applicable.

X. Termination for Cause: Termination by DPU for cause, default or negligence on the part of the Provider shall be excluded from the foregoing provision; termination costs, if any, shall not apply. The sixty (60) days advance notice requirement is waived in the event of Termination for Cause.

6. Special Terms and Conditions

A. Definition of Terms: The terms "Manufacturer/Supplier" or "Provider" as used in this RFP shall refer to the Provider for Scope of Services specified herein including any manufacturers, suppliers or subcontractors utilized to furnish the Equipment specified. The term "Installing Contractor" as used in the RFP shall refer to a separate party contracted by DPU to install the Equipment provided under this RFP.

B. Performance and Payment Bonds: A performance and payment bond in the amount of one hundred percent (100%) of the estimated value of the Contract shall be required of the successful Provider. These bonds shall be in a form acceptable to DPU and executed by a Surety duly authorized to do business in the Commonwealth of Virginia.

C. Retainage: Under the provisions of *Code of Virginia* §2.2-4333, the Provider shall be paid at least ninety-five percent of the earned sum when payment is due, with no more than five percent being retained to ensure faithful performance of the Contract. All amounts withheld may be included in the Final Payment. Any subcontract for a public project that provides for similar progress payments shall be subject to the provisions of this section. The Provider may request release of retainage for any portion of the Work completed and accepted provided, however, that adequate progress is being made and DPU approves such release.

D. Partial Payment: DPU will pay the Provider percentages of the contract price according to the following schedule:

   1) 10% within 30 days of approval of shop drawings by DPU.

   2) 80% (90% cumulative) within 30 days of delivery of the Equipment to the Water Operations Center, Central Stores, 2111 Beery Road, Harrisonburg, VA. Equal partial payments will be made for each motor upon acceptance of delivery if shipments are individually sequenced.

E. Final Payment: The final payment, which will include the 10% remaining less any amounts due or claimed by DPU as retainage, shall not become due until all punch list items have been resolved to the satisfaction of DPU and after the Provider has conducted all training and has delivered all documents as described in the Specifications. Within 30 days of completion of said items, DPU shall pay the Provider the amount therein stated, less all prior partial payments.

7. Instructions for Preparing and Submitting Proposals

A. Questions and Inquiries: Procedural questions about this RFP should be in writing and directed to: Pat Hilliard, Purchasing Agent at Purchasing@harrisonburgva.gov. Technical questions should be directed in writing to Mike Collins, Director of Utilities at mcollins@harrisonburgva.gov. All relevant questions will be answered by written addendum to www.harrisonburgva.gov/bids and on the State of VA purchasing webpage at www.eva.virginia.gov. All questions must be submitted in writing a minimum of seven calendar days prior to solicitation due date in order to be considered).

B. If any Provider would like to request a time to conduct an additional site visit, those visits may be scheduled by contacting the Public Utilities Department.

C. Contents of Proposals: Information contained in the proposal shall be stated in a clear and concise manner specific to the product being offered and the specifications outlined herein.

D. The Provider's Technical Submittal shall be organized in accordance with the following Table of Contents. Each page of the submission should be numbered sequentially.

1) Table of Contents

Section	Title
1	Executive Summary
2	Manufacturer Information, Relevant Experience and References
3	Guaranteed Delivery Schedule within 90 days of order date
4	Response to RFP Technical Requirements
5	Vendor Identification/Ownership Disclosure Statement
6	Price Quotation Form

2) Executive Summary

a. Provide an executive summary highlighting key aspects of the proposal excluding cost information.

b. The executive summary should not exceed one page in length.

c. The executive summary shall clearly state and identify who the sole responsible party is for submitting the proposal. There shall only be one responsible party/Provider.

3) Manufacturer Information, Relevant Experience and References

a. The Manufacturer is defined as the party that actually manufacturers the motors.

b. Identify the location of the corporate headquarters and the location of the facility where the equipment will be manufactured for this project.

c. Identify the Project Manager, Applications Engineer and Field Representativethat will be assigned to this project. Provide brief descriptions of their experience and qualifications.

d. As part of cost proposal, include a recommended six-month supply of all consumables as required for continuous operation of the Equipment (oil, lubricants, etc.).

e. As part of cost proposal, include all special tools required for routine and preventative maintenance.

f. Provide a brief company history detailing product lines and history of manufacturing equipment meeting the requirements of this RFP.

g. List all professional and technical certifications/affiliations.

h. Description of company structure and identify and outline any and all relationships with any partners, equipment suppliers and/or consultants that would be used for this project.

i. Location of nearest authorized Field Representative and the source and location of origin for spare parts for the Equipment. Provide legal name, address and contact person for the authorized service representative(s). Provide the number of trained service technicians employed by the service representative.

j. Describe the customary technical support provided after the completion of the contractual warranty period.

k. Provide a list of recommended spare parts for DPU to retain on-site and include in cost proposal.

l. Demonstrate a minimum of ten (10) project references demonstrating relevant experience in the manufacture and installation of the exact model or equivalent (larger) motor for vertical turbine pumping applications for drinking water or raw water supply for a public drinking water source. Provide references showing relevant experience in the last ten (10) years with a description of each contract, dates, and delineation of specific equipment provided.

m. Demonstrate a minimum of ten (10) project references demonstrating relevant experience in vibration analysis substantially similar to that required in the RFP for the exact model or equivalent (larger) motor for vertical turbine pumping applications for drinking water or raw water supply for a public drinking water source. Provide references showing relevant experience in the last ten (10) years with a description of each contract, dates, and delineation of specific equipment provided.

n. Provide Owner and Operator contacts for the references/installations listed above. Contact names and telephone numbers are to be provided for all references.

o. State the motor horsepower provided for all references/installations listed above.

4) Guaranteed Schedule

a. Provider shall provide a guaranteed schedule from issuance of PO to delivery of Equipment to DPU.

b. Delivery of three (3) hard copies of the O&M manual and an electronic copy in PDF format is a requirement in meeting the equipment delivery schedule requirements to the job site.

E. The Price Quotation Form shall contain the following items:

1) The base price for the Equipment to achieve the performance requirements listed in the RFP.

2) Additional cost for providing an extended warranty from 24 months to 36 months from start-up.

3) If applicable, add or deduct pricing for any other suggested alternate equipment/accessories.

F. Proposal Submission Procedure

1) Proposals must be received at the City of Harrisonburg, Purchasing Department, 345 South Main Street, Room 201, Harrisonburg, VA 22801 BEFORE 2:00 P.M., Local Prevailing Time, February 20, 2014. Proposals may be hand delivered, mailed, delivered by courier, or shipped to the location above.

2) Each proposal shall be submitted in a sealed envelope with the outside of the envelope stating the name of the Provider, return mail address, telephone number and the following identification: "RFP No. 2014028-PU-P : NORTH RIVER PUMP STATION UPGRADE 2013; CONTRACT 3 FOR MOTOR REPLACEMENT".

3) Provide one bound copy of the proposal with original signature. Faxed or e-mailed proposals will not be accepted. Proposals received after the appointed acceptance date and time will not be accepted. It is the sole responsibility of the bidder to ensure their proposal arrives on time. The City of Harrisonburg will not be responsible for any delays.

4) Providers, prospective bidders, vendors or other interested parties requiring "reasonable accommodation" under the Americans with Disabilities Act for submission of proposals, authorized inspection visits or appropriate data collection on DPU property, or any other procurement-related contact with DPU staff, must contact the DPU Director in a timely manner to arrange such accommodations as appropriate.

H. DPU to Bind Firm in Contract: Proposals must give the full name and address of the vendor. Failure to manually sign the Proposal may disqualify it. The person signing the Proposal shall show Title or Authority to bind his/her firm in a contract.

I. Rights of DPU: DPU reserves the right to accept or reject all or any part of any proposal, waive informalities and award the Contract to best serve the interest of DPU.

J. The contents of the Proposal submitted by the successful Provider and this RFP will become part of any contract/PO awarded as a result of the Scope of Work contained herein.

K. Costs of Proposal Preparation: Any costs incurred by the Providers in preparing or submitting proposals are the Provider's responsibility. DPU will not reimburse any Provider for any costs incurred as a result of a response to this RFP.

L. Addendum and Supplement to Request: Only written communications relative to this procurement will be considered. No oral communication by either the Provider or any representative of DPU shall alter or amend the intention of these specifications or be binding thereupon. Written addenda will be issued for any clarifications and or changes necessitated by appropriately posed questions from potential Providers and /or representatives of DPU. Written acknowledgement of all addenda is necessary for the bid to be considered complete and responsive. Addenda will be posted on the City web site www.harrisonburgva.gov/bids and the State of VA purchasing web site at www.eva.virginia.gov. It is the responsibility of the proposer to obtain all addenda information before submitting their proposal. Any and all Addenda must be signed and returned as part of the proposal.

8. Evaluation of Proposals

A. DPU will review and rank the proposals from each Provider based upon the factors itemized below. Weighting factors will be applied to each category.

1) Quality Factors

a. Relevant Manufacturer experience and performance track-record. (5%)

b. Demonstrated experience in vibration analysis (5%)

c. Compliance with all aspects of the RFP (5%)

d. Demonstrated Quality Assurance/ Quality Control (QA/QC) (5%)

e. Guaranteed delivery schedule (15%)

f. Provider's technical approach to integrate proposed products/motors with existing pump configuration, frames and mounts (15%)

2) Cost Factors

g. Equipment Cost (50%)

B. Each proposal will be evaluated with respect to compliance with all technical and administrative requirements as detailed in the RFP.

C. References will be evaluated based on the similarity of the installation as well as comments received from the reference.

D. QA/QC will be evaluated based on the Provider's QA/QC program and ISO certification(s).

E. Selection shall be made of two or more offerers deemed fully qualified and best suited among those submitting proposals on the basis of the factors outlined in this request for proposals, including price. Negotiations shall then be conducted with each of the offerers so selected. Prices shall be considered, but need not be the sole determining factor. After negotiations have been conducted with each offeror so selected, the purchasing agent shall select the offeror which in the City's opinion has made the best proposal and shall award the contract to that offeror. Should the purchasing agent determine in writing an in his or her sole discretion that only one offeror is fully qualified, or that one offeror is clearly more highly qualified than the others under consideration, a contract may be negotiated and awarded to that offeror.

F. DPU reserves the right to not award/select any proposal at its sole discretion. DPU may choose to award based solely upon the base bid or any combination of base bid and additive/deductive alternates at DPU's sole discretion.

G. From the date that the proposals are due, DPU will have 90 days to issue Notice of Award to the Manufacturer/Supplier for the Equipment. A written notice of award shall be provided to the successful Provider within the specified acceptance period.

H. Notice of Award: DPU will provide public notice announcing its decision to award the contract by posting the Notice of Intent to Award on the the City of Harrisonburg's Purchasing web page at: (www.harrisonburg.va.bids; and on the *eVA* website (http://eva.virginia.gov/).

9. Price Quotation Form

North River Pump Station Motor Replacement
RFP No. 2014028-PU-P

Item #	Description	Price
1	Total Price (3-400 Hp; 480V Motors)	
Additional Optional Add/Deduct Items		Price
AD-1	4th 400 Hp, 480V Motor (Add)	$
AD-2	Additional 36 Month Warranty (Add)	$
AD-3	Daily Rate - Field Representative (Add)	$
AD-4	Salvage Value of Existing Motors (Deduct/Credit)	($)

Note: Prices are to include all charges, F.O.B. delivery site at Central Stores, 2111 Beery Road, Harrisonburg Virginia. Exceptions to specification listed in the Scope of Services, if any, shall be enumerated below:

_____

_____

BID PACKAGE CONFORMITY CHECKLIST

ITEM #	DESCRIPTION	INCLUDED
1	RFP COVER PAGE AND ACKNOWLEDGEMENT OF ADDENDA	Y N
2	BIDDERS TECHNICAL SUBMITTAL PACKAGE	Y N
3	PRICE QUOTATION FORM (THIS PAGE)	Y N
4	VENDOR IDENTIFICATION & OWNERSHIP DISCLOSURE FORM	Y N
5	IDENTIFICATION OF PROPRIETARY/CONFIDENTIAL INFORMATION FORM	Y N
6	VIRGINIA STATE CORPORATION COMMISSION FORM	Y N
7	CONTRACTOR/VENDOR ACKNOWLEDGES INSURANCE REQUIREMENTS, AND CONTRACT PERFORMANCE AND PAYMENT BOND REQUIREMENTS IF AWARDED THE CONTRACT	Y N

By: _____

(Business Name)

_____

(Name and signature of person authorized to sign)

_____

(Title of person authorized to sign)

10. Vendor Identification and Ownership Disclosure

North River Pump Station Motor Replacement

RFP No. 2014028-PU-P

Company:					
Address:					
Contact Person:					
Telephone:		Fax:		E-Mail:	
Organized under the laws of the State of:					
Principal place of business:					
Following list includes persons having ownership of 3% or more in the company (attach more sheets if necessary):					
Name			**Address**		

DPU requests that any consultant, firm or vendor receiving a contract of award resulting from an RFP issued by DPU shall make certification as specified below. Receipt of such certification, shall be a prerequisite to the award of contract and payment thereof.

Section II – Employees Not to Benefit

I (we) hereby certify that if the contract is awarded to our firm, partnership, or corporation, that no employees of DPU or members of his/her immediate family, including spouse, parents or children has received or been promised, directly or indirectly, any financial benefit, by way of fee, commission, finder's fee, political contribution or any similar form of remuneration on account of the act of awarding and/or executing this contract.

Section III – Conflicts of Interest

This solicitation is subject to the provisions of VA Code §2.1-639.2 et. seq, the State and Local Government Conflict of Interests Act. The Vendor [ ] is [ ] is not aware of any information bearing on the existence of any potential organizational conflict of interest.

Section IV – Collusion

I certify that this offer is made without prior understanding, agreement, or connection with any corporation, firm, or person submitting an offer for the same services, materials, supplies, or equipment and is in all respects fair and without collusion or fraud. I understand collusive bidding is a violation of the State and Federal law and can result in fines, prison sentences, and civil damages.

I hereby certify that the responses to the above representations, certifications, and other statements are accurate and complete. I agree to abide by all condition of this RFP and certify that I am authorized to sign for my company.

Signature: _____ **Date:** _____

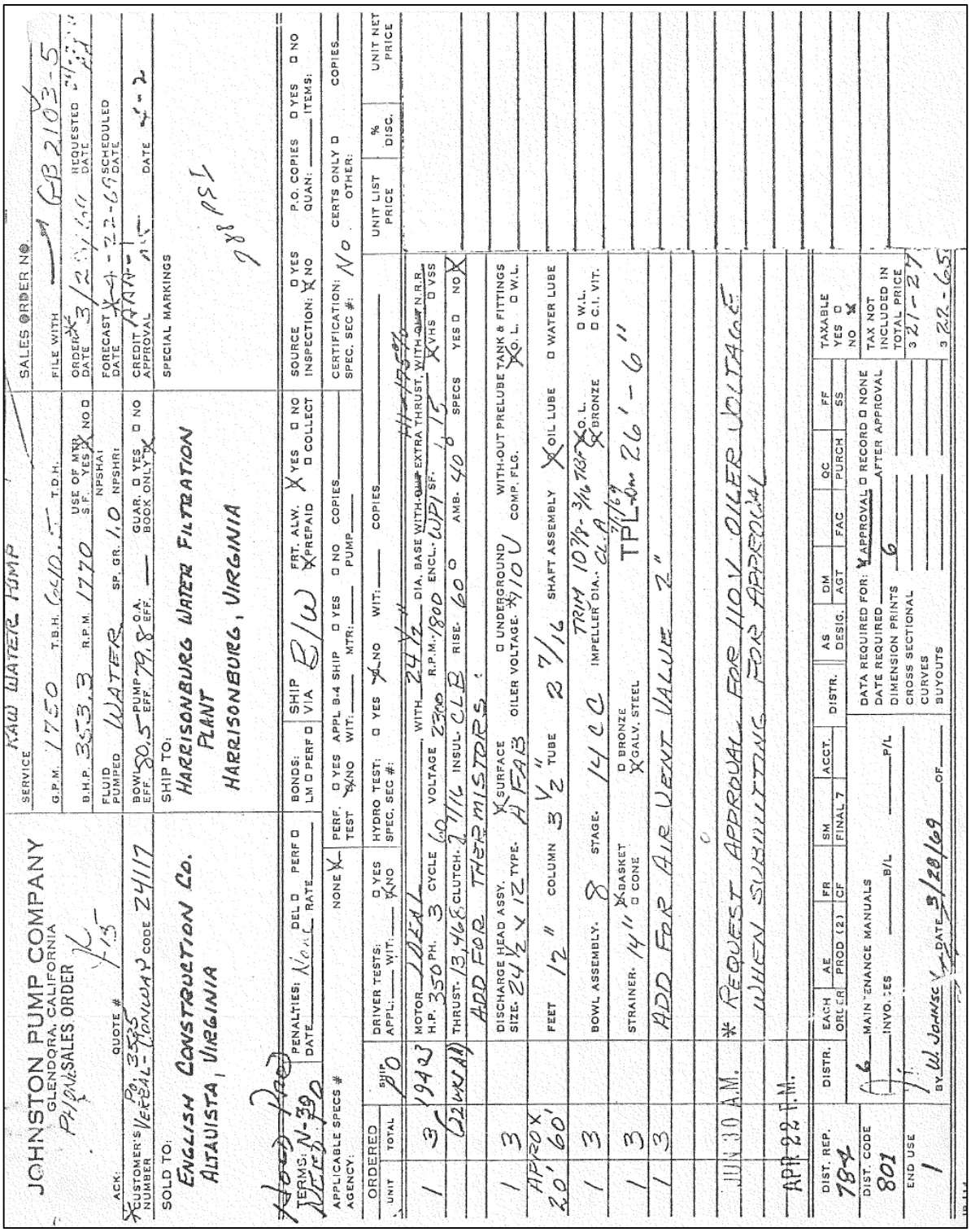
Print: _____ **Title:** _____

North River Pump Station Motor Replacement

RFP No. 2014028-PU-P

ATTACHMENT A1:

RECORD INSTALLATION DATA -EXISTING NORTH RIVER PUMP STATION MOTORS



ENGLISH CONSTRUCTION CO.

CHECKED R.K.S.
DATE 7-17-69

QUAN 3 PURCHASE ORDER NO. 19403 DIRECT/STOCK

REVISIONS
NO. BY DATE

IDEAL VERTICAL ~~(SOLID)~~ (HOLLOW) SHAFT, TYPE AT ~~(NORMAL)~~ EXTRA (HIGH) ~~(MEDIUM)~~ 175% THRUST

WITH ~~(BALL)~~ NON REVERSE RATCHET, DOWNTHRUST CAPACITY 13,500 LBS.

350 H.P. 3 PHASE 60 CYCLE 2300 VOLTS 1775 RPM V-588 FRAME SIZE

BD 24½" NEMA (P) ~~(J)~~ BASE, AK 13½" AG 65¼" CD: 58¾" CLUTCH BORE 2 7/16"

ENCLOSURE- ~~(DRIP PROOF)~~ (WEATHER PROTECTED NEMA 1 ~~(EXPLOSION PROOF CLASS I GROUP D)~~
~~(OPEN) (TEFC) (SPLASH PROOF) (CHEMICAL TYPE)~~ 1.15 SERVICE FACTOR

INSULATION TO BE CLASS "B" 60° C RISE

PROVIDE WINDING THERMOSTATS

SHAFT ROTATION TO BE COUNTERCLOCKWISE WHEN LOOKING DOWN ON TOP OF MOTOR
LOCK FOR 30% MOMENTARY UPTHRUST - MAXIMUM ENDPLAY - .010"

SOLID SHAFT ONLY — MOTOR SHAFT DIMENSIONS. U — AH — NEMA STANDARD RING KEYWAY/KEYWAY PER M-1394-A

~~MOTOR TO CONFORM TO FEDERAL SPEC. CG-M-641 CLASS I AND MIL-P-13350 (DE)~~

PAINTING TO CONFORM TO ~~MIL-P-704 COLOR~~ JOHNSON PUMP CO. GREEN

~~ACTUAL SUBJECT TO INSPECTION BY (NAVY) (U.S.E.E.) INSPECTOR~~

PREORDER — PREORDER - SHIP TO
MAIL TO JOHNSTON PUMP CO. - ATTN. PURCHASING CERTIFIED DIMENSION PRINTS FOR APPROVA

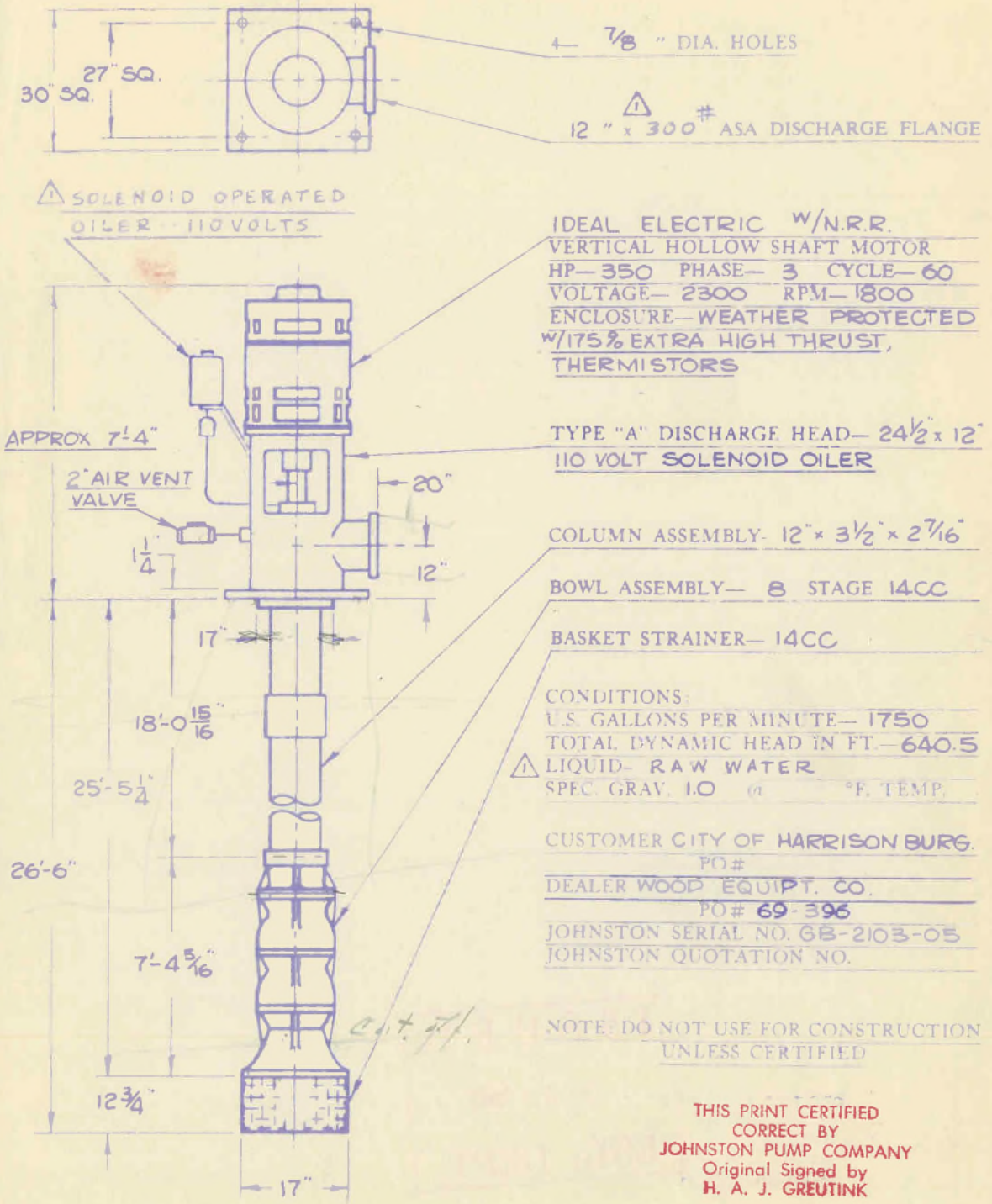
H-O-L-D F-O-R A-P-P-R-O-V-A-L

FURNISH BY RETURN MAIL ATTN: JOHNSTON PUMP COMPANY PURCHASING DEPARTMENT
MARK - FOR - INSTALLATION
7 CERTIFIED DIMENSION PRINTS, REPAIR PARTS LIST AND INSTRUCTION MANUALS

FORCAST DATE 4-22-69

ORDER NO. GB 2103-05
NO. OF UNITS 3
SHEET 1 OF 4 SH

JOHNSTON VERTICAL TURBINE PUMP
RAW WATER PUMP



IDEAL ELECTRIC W/N.R.R.
VERTICAL HOLLOW SHAFT MOTOR
HP— 350 PHASE— 3 CYCLE— 60
VOLTAGE— 2300 RPM— 1800
ENCLOSURE— WEATHER PROTECTED
W/175% EXTRA HIGH THRUST,
THERMISTORS

TYPE "A" DISCHARGE HEAD— 24½" x 12"
110 VOLT SOLENOID OILER

COLUMN ASSEMBLY- 12" x 3½" x 2 7/16"

BOWL ASSEMBLY— 8 STAGE 14CC

BASKET STRAINER— 14CC

CONDITIONS:
U.S. GALLONS PER MINUTE— 1750
TOTAL DYNAMIC HEAD IN FT.— 640.5
1 LIQUID- RAW WATER
SPEC. GRAV. 1.0 @ °F. TEMP.

CUSTOMER CITY OF HARRISONBURG.
PO#
DEALER WOOD EQUIPT. CO.
PO# 69-396
JOHNSTON SERIAL NO. GB-2103-05
JOHNSTON QUOTATION NO.

NOTE: DO NOT USE FOR CONSTRUCTION UNLESS CERTIFIED

THIS PRINT CERTIFIED
CORRECT BY
JOHNSTON PUMP COMPANY
Original Signed by
H. A. J. GREUTINK

JOHNSTON PUMP CO.
GLENDORA, CALIFORNIA

H-2804-A

G.H. A-25-69

1 REV. PER CUST. REQUEST 7-17-69 W.S.T.

RAW WATER PUMPS

A. Manufacturer- Johnston Pump Co.
Glendora, California

B. Serial Numbers-
#1. G.B. 2105
#2. G.B. 2104
#3. G.B. 2103

C. General Info-
12" X 300# Discharge Flange
Type "A" Discharge Head- 24½" X 12"
110 Volt Solenoid Oiler
Column Assembly- 12" X 3½" X 2 7/16"
Bowl Assembly- 8 Stage 14CC
Basket Strainer- 14CC

D. Conditions:
1750 U.S. Gallons per minute
640.5 Total Dynamic Head in Feet
Raw Water- Liquid
1.0-Specific Gravity

RAW WATER PUMP MOTORS

Manufacturer- Ideal Electric & Manufacturing Co.
Mansfield, Ohio

General Info:
Type "AT"
NEMA 1 Weather Protected
Vertical Hollow Shaft
Squirrel Cage Induction

350 HP	60 Hertz
1.15 Service Factor	Amb 40°C (104°F)
2300 Volts	Code "F"
77 Amps	Frame-V588
1775 RPM	Class B Insulation
60°C Temp. Rise by Thermometer	3-Klixon Winding Thermostats, N.C. Contacts
Continuous Duty	Non-Reverse Ratchet Type Coupling
Phase 3	

Thrust-13,500 lbs. Continuous Down with Bearing [redacted] based on 1 year minimum life.
Rotation-Counter Clockwise looking down on motor.

A-5

PROPRIETARY/CONFIDENTIAL INFORMATION IDENTIFICATION

ATTACHMENT A2

Name of Firm/Offeror:_____

Trade secrets or proprietary information submitted by an offeror shall not be subject to public disclosure under the Virginia Freedom of Information Act; however, the offeror must invoke the protections of §2.2-4342F of the Code of Virginia, in writing, either before or at the time the data or other material is submitted. The written notice must specifically identify the data or materials to be protected, including the section of the proposal in which it is contained, as well as the page number(s), and state the reasons why protection is necessary. The proprietary or trade secret material submitted must be identified by some distinct method such as highlighting or underlining and must indicate only the specific words, figures, or paragraphs that constitute a trade secret or proprietary information. In addition, a summary of proprietary information provided shall be submitted on this form. The designation of an entire proposal document, line item prices, and/or total proposal prices as proprietary or trade secrets is not acceptable. If, after being given reasonable time, the offeror refuses to withdraw such a classification designation, the proposal will be rejected.

SECTION/TITLE	PAGE NUMBER(S)	REASON(S) FOR WITHHOLDING FROM DISCLOSURE

☐ Check this box if there are none.

ATTACHMENT A3

State Corporation Commission Form
(RFP)

Virginia State Corporation Commission ("SCC") registration information: **The undersigned Offeror:**

☐ is a corporation or other business entity with the following SCC identification number: _____ **-OR-**

☐ is not a corporation, limited liability company, limited partnership, registered limited liability partnership, or business trust **-OR-**

☐ is an out-of-state business entity that does not regularly and continuously maintain as part of its ordinary and customary business any employees, agents, offices, facilities, or inventories in Virginia (not counting any employees or agents in Virginia who merely solicit orders that require acceptance outside Virginia before they become contracts, and not counting any incidental presence of the Offeror in Virginia that is needed in order to assemble, maintain, and repair goods in accordance with the contracts by which such goods were sold and shipped into Virginia from bidder's out-of-state location) **-OR-**

☐ is an out-of-state business entity that is including with this RFP an opinion of legal counsel which accurately and completely discloses the undersigned Offeror's current contacts with Virginia and describes why those contacts do not constitute the transaction of business in Virginia within the meaning of § 13.1-757 or other similar provisions in Titles 13.1 or 50 of the Code of Virginia.

****NOTE** >>** Check the following box if you have not completed any of the foregoing options but currently have pending before the SCC an application for authority to transact business in the Commonwealth of Virginia and wish to be considered for a waiver to allow you to submit the SCC identification number after the due date for proposals (the Commonwealth reserves the right to determine in its sole discretion whether to allow such waiver):

Signature: _____ Date: _____

Name: _____
Print

Title: _____

Name of Firm: _____

GENERAL TERMS AND CONDITIONS FOR THE CITY OF HARRISONBURG, VA

PURCHASING AND CONTRACTING MANUAL: This solicitation is subject to the provisions of The Purchasing and Contracting Policy Manual for the City of Harrisonburg (City) and any revisions thereto, which are hereby incorporated into this contract in their entirety. A copy of the manual is available for review at www.Harrisonburgva.gov/bids.

APPLICABLE LAWS AND COURTS: This solicitation and any resulting contract shall be governed in all respects by the laws of the Commonwealth of Virginia and any litigation with respect thereto shall be brought in the courts of the Commonwealth. The contractor shall comply with all applicable federal, state and local laws, rules and regulations.

ANTI-DISCRIMINATION: By submitting their (bids/proposals), (bidders/offerors) certify to the City that they will conform to the provisions of the Federal Civil Rights Act of 1964, as amended, as well as the Virginia Fair Employment Contracting Act of 1975, as amended, where applicable, the Virginians With Disabilities Act, the Americans With Disabilities Act and 2.2-4311 of the *Virginia Public Procurement Act*.

In every contract over $10,000 the provisions below apply:

1. During the performance of this contract, the contractor agrees as follows:

   a. The contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, age, disability, or any other basis prohibited by state law relating to discrimination in employment, except where there is a bona fide occupational qualification reasonably necessary to the normal operation of the contractor. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.

   b. The contractor, in all solicitations or advertisements for employees placed by or on behalf of the contractor, will state that such contractor is an equal opportunity employer.

   c. Notices, advertisements and solicitations placed in accordance with federal law, rule or regulation shall be deemed sufficient for the purpose of meeting these requirements.

   The contractor will include the provisions of 1. above in every subcontract or purchase order over $10,000, so that the provisions will be binding upon each subcontractor or vendor.

2. The City does not discriminate against small and minority businesses or faith based organizations.

ETHICS IN PUBLIC CONTRACTING: By submitting their (bids/proposals), (bidders/offerors) certify that their (bids/proposals) are made without collusion or fraud and that they have not offered or received any kickbacks or inducements from any other (bidder/offeror), supplier, manufacturer or subcontractor in connection with their (bid/proposal), and that they have not conferred on any public employee having official responsibility for this procurement transaction any payment, loan, subscription, advance, deposit of money, services or anything of more than nominal value, present or promised, unless consideration of substantially equal or greater value was exchanged.

IMMIGRATION REFORM AND CONTROL ACT OF 1986: By submitting their (bids/proposals), (bidders/offerors) certify that they do not and will not during the performance of this contract employ illegal alien workers or otherwise violate the provisions of the federal Immigration Reform and Control Act of 1986.

DEBARMENT STATUS: By submitting their (bids/proposals), (bidders/offerors) certify that they are not currently debarred by the Commonwealth of Virginia from submitting bids or proposals on contracts for the type of goods and/or services covered by this solicitation, nor are they an agent of any person or entity that is currently so debarred.

ANTITRUST: By entering into a contract, the contractor conveys, sells, assigns, and transfers to the City all rights, title and interest in and to all causes of action it may now have or hereafter acquire under the antitrust laws of the United States and the Commonwealth of Virginia, relating to the particular goods or services purchased or acquired by the City under said contract.

MANDATORY USE OF CITY FORM AND TERMS AND CONDITIONS FOR IFBs AND RFPs

1. (For Invitation For Bids(ITB):) Failure to submit a bid on the form provided, (if provided) shall be a cause for rejection of the bid. Modification of or additions to any portion of the Invitation for Bids may be cause for rejection of the bid; however, the City reserves the right to decide, on a case by case basis, in its sole discretion, whether to reject such a bid as nonresponsive. As a precondition to its acceptance, the City may, in its sole discretion, request that the bidder withdraw or modify nonresponsive portions of a bid which do not affect quality, quantity, price, or delivery. No modification of or addition to the provisions of the contract shall be effective unless reduced to writing and signed by the parties.

2. (For Request For Proposals(RFP):) Failure to submit a proposal on the form provided, (if provided) shall be a cause for rejection of the bid. Modification of or additions to the General Terms and Conditions of the solicitation may be cause for rejection of the proposal; however, the City reserves the right to decide, on a case by case basis, in its sole discretion, whether to reject such a proposal.

REVISIONS TO THE OFFICIAL ITB/RFP: No offeror shall modify, revise, edit or make any unauthorized change(s) to the original Official Invitation to Bid (ITB) or Official Request for

Proposal (RFP). The Official solicitation document and the Addenda(s) are the documents posted on the City of Harrisonburg's web site and/or authorized by the City of Harrisonburg's Purchasing Agent. Any such violation as stated above may result in rejection of the ITB/RFP response. In addition, violations may result in the debarment of the offeror by the City of Harrisonburg.

CLARIFICATION OF TERMS: If any prospective (bidder/offeror) has questions about the specifications or other solicitation documents, the prospective (bidder/offeror) should contact the person whose name appears on the face of the solicitation no later than five working days before the due date. Any revisions to the solicitation will be made only by addendum issued by the buyer.

PAYMENT:

1. To Prime Contractor:

   a. Invoices for items ordered, delivered and accepted shall be submitted by the contractor directly to the payment address shown on the purchase order/contract. All invoices shall show the purchase order number; social security number (for individual contractors) or the federal employer identification number (for proprietorships, partnerships, and corporations).

   b. Any payment terms requiring payment in less than 30 days will be regarded as requiring payment 30 days after invoice or delivery, whichever occurs last. This shall not affect offers of discounts for payment in less than 30 days, however.

   c. All goods or services provided under this contract or purchase order, that are to be paid for with public funds, shall be billed by the contractor at the contract price.

   d. The following shall be deemed to be the date of payment: the date of postmark in all cases where payment is made by mail, or the date of offset when offset proceedings have been instituted as authorized under the Virginia Debt Collection Act.

   e. Individual contractors shall provide their social security numbers, and proprietors , partnerships, and corporations shall provide the City with a federal employer identification number, prior to receiving any payment from the City.

   f. **Unreasonable Charges**. Under certain emergency procurements and for most time and material purchases, final job costs cannot be accurately determined at the time orders are placed. In such cases, contractors should be put on notice that final payment in full is contingent on a determination of reasonableness with respect to all invoiced charges. Charges which appear to

be unreasonable will be researched and challenged, and that portion of the invoice held in abeyance until a settlement can be reached. Upon determining that invoiced as to those charges which it considers unreasonable and the basis for the determination. A contractor may not institute legal action unless a settlement cannot be reached within thirty (30) days of notification. The provisions of this section do not relieve the City of its prompt payment obligations with respect to those charges which are not in dispute (*Code of Virginia*, 2.2.4363.

2. To Subcontractors:

   a. A contractor awarded a contract under this solicitation is hereby obligated:

      (1) To pay the subcontractor(s) within seven (7) days of the contractor's receipt of payment from the City for the proportionate share of the payment received for work performed by the subcontractor(s) under the contract; or

      (2) To notify the City and the subcontractor(s), in writing, of the contractor's intention to withhold payment and the reason.

   b. The contractor is obligated to pay the subcontractor(s) interest at the rate of one percent per month (unless otherwise provided under the terms of the contract) on all amounts owed by the contractor that remain unpaid seven (7) days following receipt of payment from the City, except for amounts withheld as stated in (2) above. The date of mailing of any payment by U. S. Mail is deemed to be payment to the addressee. These provisions apply to each sub-tier contractor performing under the primary contract. A contractor's obligation to pay an interest charge to a subcontractor may not be construed to be an obligation of the City.

PRECEDENCE OF TERMS: General Terms and Conditions shall apply in all instances. In the event there is a conflict between any of the other General Terms and Conditions and any Special Terms and Conditions in this solicitation, the Special Terms and Conditions shall apply.

QUALIFICATIONS OF (BIDDERS/OFFERORS): The City may make such reasonable investigations as deemed proper and necessary to determine the ability of the (bidder/offeror) to perform the services/furnish the goods and the (bidder/offeror) shall furnish to the City all such information and data for this purpose as may be requested. The City reserves the right to inspect (bidder's/offeror's) physical facilities prior to award to satisfy questions regarding the (bidder's/offeror's) capabilities. The City further reserves the right to reject any (bid/ proposal) if the evidence submitted by, or investigations of, such (bidder/offeror) fails to satisfy the City that such (bidder/offeror) is properly qualified to carry out the obligations of the contract and to provide the services and/or furnish the goods contemplated therein.

TESTING AND INSPECTION: The City reserves the right to conduct any test/inspection it may deem advisable to assure goods and services conform to the specifications.

ASSIGNMENT OF CONTRACT: A contract shall not be assignable by the contractor in whole or in part without the written consent of the City.

CHANGES TO THE CONTRACT: Changes can be made to the contract in any of the following ways:

1. The parties may agree in writing to modify the scope of the contract. An increase or decrease in the price of the contract resulting from such modification shall be agreed to by the parties as a part of their written agreement to modify the scope of the contract.
2. The Purchasing Agent or City delegated agent may order changes within the general scope of the contract at any time by written notice to the contractor. Changes within the scope of the contract include, but are not limited to, things such as services to be performed, the method of packing or shipment, and the place of delivery or installation. The contractor shall comply with the notice upon receipt. The contractor shall be compensated for any additional costs incurred as the result of such order and shall give the City a credit for any savings.

DEFAULT: In case of failure to deliver goods or services in accordance with the contract terms and conditions, the City, after due oral or written notice, may procure them from other sources and hold the contractor responsible for any resulting additional purchase and administrative costs. This remedy shall be in addition to any other remedies, which the City may have.

CANCELLATION OF THE CONTRACT: The City may terminate any agreement resulting from this solicitation at any time, for any reason or for no reason, upon thirty days advance written notice to the Contractor. In the event of such termination the Contractor shall be compensated for services and work performed prior to termination.

TAXES: Sales to the City of Harrisonburg are normally exempt from State sales tax. State sales and use tax certificates of exemption, Form ST-12, will be issued upon request.

(NOT NORMALLY REQUIRED FOR SERVICE CONTRACTS)

USE OF BRAND NAMES: Unless otherwise provided in this solicitation, the name of a certain brand, make or manufacturer does not restrict (bidders/offerors) to the specific brand, make or manufacturer named, but conveys the general style, type, character, and quality of the article desired. Any article which the public body, in its sole discretion, determines to be the equal of that specified, considering quality, workmanship, economy of operation, and suitability for the purpose intended, shall be accepted. The (bidder/offeror) is responsible to clearly and specifically identify the product being offered and to provide sufficient descriptive literature, catalog cuts and technical detail to enable the City to determine if the product offered meets the requirements of the solicitation. This is required even if offering the exact brand, make or manufacturer specified. Normally in

competitive sealed bidding only the information furnished with the bid will be considered in the evaluation. Failure to furnish adequate data for evaluation purposes may result in declaring a bid nonresponsive. Unless the (bidder/offeror) clearly indicates in its (bid/proposal) that the product offered is an "equal" product, such (bid/proposal) will be considered to offer the brand name product referenced in the solicitation.**(NOT NORMALLY REQUIRED FOR SERVICE CONTRACTS)**

TRANSPORTATION AND PACKAGING: By submitting their (bids/proposals), all (bidders/offerors) certify and warrant that the price offered for FOB destination includes only the actual freight rate costs at the lowest and best rate and is based upon the actual weight of the goods to be shipped. Except as otherwise specified herein, standard commercial packaging, packing and shipping containers shall be used. All shipping containers shall be legibly marked or labeled on the outside with purchase order number, commodity description, and quantity.**(NOT NORMALLY REQUIRED FOR SERVICE CONTRACTS)**

INSURANCE: By signing and submitting a bid or proposal under this solicitation, the bidder or offeror certifies that if awarded the contract, it will have insurance coverages per the solicitation document at the time the contract is awarded. For construction contracts, if any subcontractors are involved, the subcontractor will have workers' compensation insurance in accordance with 2.2-4332 and 65.2-800 et seq. of the *Code of Virginia*. The bidder or offeror further certifies that the contractor and any subcontractors will maintain these insurance coverages during the entire term of the contract and that all insurance coverages will be provided by insurance companies authorized to sell insurance in Virginia by the Virginia State Corporation Commission. **(NOT NORMALLY REQUIRED FOR GOODS CONTRACTS. INSURANCE IS REQUIRED WHEN WORK IS TO BE PERFORMED ON CITY OWNED OR LEASED FACILITIES OR PROPERTY.)**

AVAILABILITY OF FUNDS: Agreements are made subject to the appropriation of funds by the Harrisonburg City Council and are null and void in the event of non-appropriation by the City Council. Non-appropriation of funds shall not be deemed a cancellation and shall terminate this agreement without recourse and with no liability on the part of the City.

SELECTION PROCESS/AWARD: Upon the award or the announcement of the decision to award a contract as a result of this solicitation, the department will publicly post such notice for a minimum of ten (10) days, or will notify all responsive bidders/offerors.

BID/PROPOSAL ACCEPTANCE PERIOD: Any bid/proposal resulting from this solicitation shall be valid for (30) days. At the end of the (30) days the bid/proposal may be withdrawn at the written request of the Bidder/Offeror. If the bid or proposal is not withdrawn at that time it remains in effect until an award is made or the solicitation is canceled.

EXCUSABLE DELAY: The City shall not be in default of any failure in performance of this agreement in accordance with its terms if such failure arises out of causes beyond its reasonable control and without the fault of or negligence of the City. Such causes may include, but are not restricted to acts of God or the public enemy, fires, flood, epidemics,

quarantine restrictions, strikes, freight embargoes, and usually severe weather, but in every case the failure to perform must be beyond the reasonable control and without the fault or negligence of the City.

DRUG-FREE WORKPLACE: During the performance of this contract, the contractor agrees to (i) provide a drug-free workplace for the contractor's employees; (ii) post in conspicuous places, available to employees and applicants for employment, a statement notifying employees that the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance or marijuana is prohibited in the contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition; (iii) state in all solicitations or advertisements for employees placed by or on behalf of the contractor that the contractor maintains a drug-free workplace; and (iv) include the provisions of the foregoing clauses in every subcontract or purchase order of over $10,000, so that the provisions will be binding upon each subcontractor or vendor.

SAFETY and OSHA STANDARDS: All parties performing services for the City shall comply with all Occupational Safety and Health Administration (OSHA), State Occupational Health Standards, and any other applicable rules and regulations. All parties shall be held responsible for the training, supervision, and safety of their employees. Any unsafe acts or hazardous conditions that may cause injury or damage to any persons or property within and around the work site areas under this contract shall be remedied per the regulatory agency's guidelines.

PERMITS AND FEES: All proposals submitted shall have included in price the cost of any business or professional licenses, permits or fees required by the City of Harrisonburg or the Commonwealth of Virginia. The offeror must have all necessary licenses to perform the services in Virginia and, if practicing as a corporation, be authorized to do business in the Commonwealth of VA.

COOPERATIVE PROCUREMENT: This procurement is being conducted on behalf of other public bodies, in accordance with 2.2-4304 (A) of the Code of VA. The successful bidder has the option to provide these same items (services), except architectural and engineering services, at the same prices, awarded as a result of this solicitation to any public body within the Commonwealth of Virginia. If any other Public body decides to use the final contract, the contractor(s) must deal directly with that public body concerning the placement of orders, issuance of the purchase orders, contractual disputes, invoicing and payment. Failure to extend a contract to any public body will have no effect on consideration of your bid.

LIABILITY AND LITIGATION: The City shall not indemnify or hold harmless any Contractor or other third party. The City does not waive any right or release any party from liability, whether on its own behalf or on behalf of any boards, employees or agents. The City does not waive the right to trial by jury for any cause of action arising from the Contract and shall not submit any Contract claim to binding arbitration or mediation. The City shall not be liable to Contractor for any special, punitive or exemplary damages arising from the performance of the contract, including, but not limited to, incidental damages, and lost

profit and lost wages, even if such special damages are reasonably foreseeable. Any provision(s) in the Contract contrary to these statements is/are hereby deleted and rendered void.

STATE CORPORATION COMMISSION IDENTIFICATION NUMBER: Pursuant to Code of VA 2.2-4311.2 subsection B, a bidder or offeror organized or authorized to transact business in the Commonwealth pursuant to Title 13.1 or Title 50 is required to include in its bid or proposal the identification number issued to it by the State Corporation Commission (SCC). Any bidder or offeror that is not required to be authorized to transact business in the Commonwealth as a foreign business entity under Title 13.1 or Title 50 or as otherwise required by law is required to include in its bid or proposal a statement describing why the bidder or offeror is not required to be so authorized. Link to the SCC site is http://www.scc.virginia.gov.

ATTACHMENT A5

CITY OF HARRISONBURG, VA
STANDARD CONTRACT RFP

This Contract entered into this ___ day of _____ 20___, by _____ hereinafter called the "Contractor" and the City of Harrisonburg, VA, called the "Owner".

WITNESSETH that the Contractor and the Owner, in consideration of the mutual covenants, promises and agreements herein contained, agree as follows:

SCOPE OF CONTRACT: The Contractor shall provide the goods/services to the Owner as set forth in the Contract Documents.

PERIOD OF PERFORMANCE: From _____ through _____.

The contract documents shall consist of:

(1) This signed form;

(2) The entire City of Harrisonburg's Official Request for Proposals

dated: _____

If applicable, any Official City Addenda(s):

#1, dated: _____

(3) The Contractor's Proposal response dated _____ and the negotiated modifications (if applicable) to the Proposal, all of which documents are incorporated herein.

IN WITNESS WHEREOF, the parties have caused this Contract to be duly executed intending to be bound thereby.

CONTRACTOR: CITY OF HARRISONBURG (OWNER):

By: _____ By: _____

Title: _____ Title: _____

DEPARTMENT OF FINANCE AND PURCHASING

345 South Main Street

Harrisonburg, VA 22801

ISSUE DATE: Nov 25, 2013	**REQUEST FOR PROPOSAL NUMBER:** 2014015-PU-P	**FOR:** North River Pump Station Variable Frequency Drives and Electrical Gear
DEPARTMENT: Public Utilities	**DATE/TIME OF CLOSING:** January 15, 2014 @ 2:30 pm local time	**CONTRACT ADMINISTRATOR:** Mike Collins, Public Utilities Director

Mandatory Pre-Proposal Meeting: Wednesday December 18, 2013 at 10:00 am at North River Pump Station

Proposals - In accordance with the following and in compliance with all terms and conditions, unless otherwise noted, the undersigned offers and agrees, if the proposal is accepted, to furnish items or services for which prices are quoted, delivered, or furnished to designated points within the time specified. It is understood and agreed that with respect to all terms and conditions accepted by the City of Harrisonburg the items or services offered and accompanying attachments shall constitute a contract.

NAME AND ADDRESS OF FIRM:

Telephone/Fax No.:

Federal Employer Identification # :

State Corporation Commission #:

E-mail:

Prompt Payment Discount: __% for payment within___days/net___ days

By signing this proposal, Vendor(s) certifies, acknowledges, understands, and agrees to be bound by the conditions set forth in this RFP.

CHECK ONE: ☐ INDIVIDUAL ☐ PARTNERSHIP ☐ CORPORATION ☐ LLC

Vendor's Legally Authorized Signature

Date

Print Name

Title

Sealed proposals, subject to terms and conditions of this Request for Proposal will be received by the City of Harrisonburg Purchasing Agent at 345 South Main St, Room 201, Harrisonburg, Virginia 22801 until the date/ time specified above for furnishing items or services delivered or furnished to specified destinations within the time specified or stipulated by the vendor(s).

The City does not discriminate against small and minority businesses or faith-based organizations.

CITY OF HARRISONBURG
DEPARTMENT OF FINANCE AND PURCHASING
AND THE DEPARTMENT OF PUBLIC UTILITIES
REQUEST FOR PROPOSAL:

RFP NO. 2014015-PU-P
NORTH RIVER PUMP STATION UPGRADE 2013
PROJECT 473-12-13
CONTRACT 2 - VARIABLE FREQUENCY DRIVES AND ELECTRICAL GEAR
DATED: NOVEMBER 25, 2013

TABLE OF CONTENTS

ATTACHMENTS:

1. PURPOSE

The City of Harrisonburg Department of Public Utilities (DPU) is requesting proposals, subject to the specifications and conditions contained herein, to provide Variable Frequency Drives (VFDs) and electrical panels and switchgear compatible with three, vertical hollow-shaft, premium efficiency 400 horsepower motors that will be installed on existing vertical turbine pumps at the North River Pump Station in Bridgewater, Virginia. Motors will be procured under a separate RFP and will be rated for use with IEEE 519 compliant VFDs and Electrical Gear.

This solicitation, and the resulting agreement, shall be consistent with the the Virginia Public Procurement Act (VPPA) and the City of Harrisonburg's Purchasing and Contracting Policy Manual. This Request for Proposal (RFP) is being utilized in lieu of an Invitation for Bid (IFB) due to the specialized nature of the electrical equipment required within this pump station and due to system standardization needs in order to be compatible with existing equipment within the pump station. This specifically includes the existing vertical turbine pumps and new motors that will be integrated with this equipment.

2. BACKGROUND INFORMATION

The DPU is responsible for providing water and sewer services to residences and businesses in the City of Harrisonburg and in portions of neighboring Rockingham County. The North River Pump Station is a key component of the raw water system operated by the DPU.

The North River Pump Station (NRPS) is located at 699 E Riverside Drive, Bridgewater, VA 22812. The NRPS pumps raw water from the North River to the Grandview Drive Water Treatment Plant and has a rated design capacity of 5,300 gallons per minute (GPM). The VFDs and Electrical Gear procured under this solicitation shall be delivered to the DPU Water Operations Center, Central Stores at 2111 Beery Road, Harrisonburg, Virginia.

3. SCOPE OF SERVICES

A. The DPU will evaluate, select and directly purchase from one (1) Manufacturer (Provider); three (3) 400 HP, 480V, 3 PH, 60Hz Variable Frequency motor controllers (VFDs), complete with associated panelboards, switchboards, transfer switches, low voltage transformers and other electrical equipment as specified within this RFP (Equipment). All equipment shall meet the Equipment requirements contained in this Request for Proposal (RFP) and the attached equipment specifications.

B. The Equipment procured under this RFP will be installed as City furnished, contractor installed material as part of the City's NRPS Improvements Project. Equipment installation will be by an independent general contractor (Installing Contractor). The Installing Contractor will install the Equipment procured under this RFP (Items a-g below) to reconfigure the NRPS to operate on 480V power. Specific electrical equipment (Equipment) to be provided on this solicitation (Contract 2) includes:

   a. Variable Frequency Motor Controllers – Three (3) 400 HP, 480V, 3 PH, 60 Hz

b. Switchboard “PS”

c. Panelboard “P1” and 75 KVA Low Voltage Transformer

d. Panelboard “EDP”

e. Panelboard “HP”

f. Manual Transfer Switch 600A for Pump P-1

g. Automatic Transfer Switch 600A for Panel EDP

C. The NRPS Improvements Project will be executed under four contracts as follows:

i. Contract 1: Install Contract;

ii. Contract 2: VFD Provider; (this solicitation)

iii. Contract 3: Motor Provider;

iv Contract 4: SCADA Provider

Contract 1, (Install Contract), includes sequenced conversion of three existing 2300 V vertical turbine pump motors to 480V operation using VFDs and electrical equipment provided on this solicitation, Contract 2 (VFD Provider). Contract 3, (Motor Provider) will provide 480V motors to be sequentially installed on each pump following terms of this contract. Each motor and pump assembly will subject to a 7-14 day commissioning period by the installing contractor (Contract 1) in cooperation with and fully supported by, the VFD Provider and Motor Provider (Contracts 2 and 3) prior to initiating work on the next pump, (four week commissioning period total). Specifications are provided specific to each contract and a full set of construction documents will be provided for the project.

4. SPECIFICATIONS

A. The Provider shall furnish and provide manufacturer support required for factory certified installation of the Equipment described in the attached specifications (Item 3B, Equipment outlined above). All Equipment shall meet the functional and performance requirements contained in this RFP and supporting attachments.

B. The Provider shall be responsible for issuing a Certificate of Proper Installation and a Certificate of Proper Operation for the Equipment in conjunction with the Installing Contractor contract.

C. The following Manufacturers will be considered as the basis-of-design Equipment requirement; alternate manufacturers meeting the performance specifications may be considered, but the City reserves the right to select Equipment based on technical need and system unity standards:

i. Square D

ii. TECO - Westinghouse

iii. ABB

iv. Allen-Bradley

D. Equipment Provider shall be responsible for coordinating with the Installing Contractor as DPU's manufacturer's agent; the Equipment shall be installed by the Installing Contractor under the direction of the Provider's manufacturer's certified field representative (Field Representative). It is projected that this installation will occur between April -July, 2014, the Installing Contractor has not been selected at this time.

E. All electrical connections that are not factory assembled and shipped complete shall be labeled and full installation coordination drawings shall be provided by the Provider to clearly delineate installation requirements to the Installing Contractor.

F. Performance Specifications: Provide Equipment in accordance with the following specifications which are attached hereto in Attachment A1.

G. Factory Finishing

i. Shop prepare, prime, and finish coat all ferrous metal components of the Equipment in accordance with the following schedule for Exposed Metal – Mildly Corrosive Environments. DPU to select finish coat colour as part of shop drawing review and approval process.

Surface Prep.	Paint Material	Min. Coats, Cover
SSPC – SP10	Epoxy Primer – Ferrous Metal	1 coat, 2.5 MDFT
	Polyurethane Enamel	1 coat, 3 MDFT

H. General Requirements

i. Safety Devices: The Equipment shall include all necessary permanent safety devices, such as machinery guards, emergency stops, non-ratcheting returns and similar items required by OSHA, and other federal, state, and local health and safety regulations.

ii. Flanges and Pipe Threads: Threaded flanges and fittings shall have standard taper pipe threads complying with ANSI/ASME B1.20.1.

iii. Provide lifting lugs for all Equipment components weighing over 100 pounds.

iv. The Equipment shall comply with all applicable federal, state and local codes and regulations to include safety and fire codes and regulations.

I. Warranty Requirements

The Provider shall provide a full written warranty for all equipment provided under this RFP. The warranty period shall be 24 months from start-up but not to exceed 30 months after the date of Substantial Completion. If a defect is found during the warranty period, the Provider shall remedy said defect at no cost to DPU. The Provider shall provide a cost adder for extending the warranty for all equipment to 36 months from start-up but not to exceed 48 months after the date of Substantial Completion.

J. Shop Testing

i. Shop test Equipment in accordance with the individual equipment specifications. Owner shall be notified prior to shop testing and reserves the right to attend and witness testing at the manufacturer's test facility (at owner expense).

ii. During the shop test the following parameters shall be recorded:

a. Serial number, model number, testing agent name, certification number and location, date and time of test. DPU shall be notified 5-days in advance of certification testing and shall be permitted unimpeded access to attend and witness factory certification testing at the manufacturer's test site. Travel cost for DPU to observe test shall be independent of Equipment cost and shall be borne by DPU.

b. Certified shop test report s shall be submitted to DPU with delivery of Equipment.

K. Field Testing

i. Provider shall conduct functional and performance field tests of the Equipment to determine systems ability to operate within the performance limits specified. The Provider shall coordinate with and direct the Installing Contractor during Equipment installation and shall be responsible for issuing a Certificate of Proper Installation and a Certificate of Proper Operation for the Equipment.

ii. Provider shall include a minimum of six days of on-site installation support with Field Representative present on site full time for 8-hours each day; (minimum of four separate visits required); additional days may be provided at Provider's discretion.

iii. Functional Test

a. Provider shall issue a Certificate of Proper Installation all Equipment prior to start up of the first VFD.

b. Provider shall issue a Certificate of Proper Operation all Equipment except for VFDs prior to start up of the first VFD.

c. Field test all equipment components for proper connection.

d. Make all adjustments necessary to place equipment in specified and working order at the time of above tests.

iv. Performance Test

a. VFD No. 1 for Pump/Motor No. 1 shall be operated for a continuous 14 day period. Upon Owner acceptance of the VFD, the Provider shall issue a Certificate of Proper Operation for VFD No. 1.

b. Following issuance of the Certificate of Proper Operation for VFD No. 1, VFD No. 2 for Pump/Motor No. 2 shall be operated for a continuous 7 day period. Upon Owner acceptance of the VFD, the Provider shall issue a Certificate of Proper Operation for VFD No. 2.

c. Following issuance of the Certificate of Proper Operation for VFD No. 2, VFD No. 3 for Pump/Motor No. 3 shall be operated for a continuous 7 day period. Upon Owner acceptance of the VFD, the Provider shall issue a Certificate of Proper Operation for VFD No. 3.

d. Providers Field Representative shall be present at the site for at least 8 hours to direct Functional Testing and Performance Testing for each VFD start-up (minimum total of 24 hours of base field time specified). The same Field Representative shall be available to return to the site within 24 hours if Performance Testing is interrupted for any reason. If Performance Testing is interrupted due to defective equipment within the scope of supply of the Provider, the Field Representative shall be present at no additional cost to Owner. If Performance Testing is interrupted due to defective equipment outside the scope of supply of the Provider, the Field Representative shall be present at a daily rate as listed in proposal (at DPU expense).

v. Promptly correct or replace all defective equipment within the scope of supply of the Provider revealed by or noted during tests at no additional cost to the DPU and repeat tests until specified results acceptable to DPU are obtained.

vi. Field testing shall be directed by the Providers Field Technician.

L. Certificates

i. A Certificate of Proper Installation for the Equipment shall be issued to and accepted by the DPU by the Provider prior to any operation or field testing of the equipment.

ii. A Certificate of Proper Operation for the Equipment shall be issued to and accepted by the DPU by the Provider in coordination with Installing Contractor.

iii. DPU acceptance of both certificates shall be a prerequisite condition for Provider to request a substantial completion inspection for final payment.

M. Training

i. The same Field Technician that directed field testing shall provide at least 4 hours of training to DPU staff with regard to: (1) operation; (2) routine maintenance; and (3) preventative maintenance procedures on the Equipment. The DPU will establish date and classroom location during which required training shall be delivered.

N. General Equipment Requirements

i. Material and equipment shall be provided that is:

a. Constructed and finished in a workmanlike manner.

b. Suitable for the purpose intended, especially as related to acceptability for use in a raw water pumping facility.

c. Selected and fabricated to the best engineering practice.

d. Mechanical and electrical equipment, particularly bearings, contacts and other wearing parts shall be designed for extended periods of operation without frequent maintenance or attention.

e. All machinery shall be designed such that all working parts are readily accessible for inspection and repair, and each part is suitable for the service required.

ii. Guards

a. Sheet-expanded guards, or equal are to be furnished on all mechanical moving parts in accordance with workplace safety regulations.

b. Guards shall be fabricated of 14 gauge steel, or equal, and painted red after fabrication to same standard as parent equipment.

c. Guards are to be removable to facilitate maintenance of moving parts.

d. Provisions are to be made to extend lube fittings through guards.

iii. Caution signs

a. Provide signage in accordance with OSHA standards and requirements:

1. All rotating equipment drives shall be identified with caution signs.

2. Caution signs shall consist of vinyl stick-on type decals positioned immediately adjacent to the rotating element and placed onto a clean, smooth surface.

3. When an insufficient space or surface exists the decal is to be applied to a galvanized mild steel, fiberglass, or plastic sheet fastened to equipment.

4. The caution signs shall read "CAUTION - AUTOMATIC EQUIPMENT MAY START AT ANY TIME".

5. Sign letters are to be 25 mm in height, in red, on a yellow background.

iv. Pilot devices

a. For electrical pilot devices including switches, relays, filters and contacts, heavy-duty industrial quality devices are to be furnished.

b. Contacts which provide alarm malfunction or control to external systems are to be rated for 10 amp continuous service at 120 volts AC. Pressure and temperature switches are to be rated for 5 amp continuous service at 120 volts AC.

v. Indicating lights

a. Oil-tight transformer type indicating lights with LED lamps are to be furnished.

O. Submittals: The following additional information shall be provided in the Provider's Technical Submission as part of this initial proposal response:

i. Equipment specific submittals as required under specifications listed Attachment A1.

ii. Provide an itemized list of all equipment that comprise the Equipment and provide cut sheet information sufficient to ensure compliance with the technical requirements of the RFP.

iii. Provide an itemized list of alternate equipment that can be offered with add or deduct pricing.

iv. The proposal shall be based upon the Equipment as set forth herein, however alternate Equipment with additive or deductive pricing can also be included at the Provider's discretion.

v. Provide itemized maintenance schedule based on equipment run time (where applicable) and calendar days for recommended operations and maintenance activities.

vi. Provide a separate daily rate for the Provider's Field Technician to be on site. This rate shall be in effect throughout the duration of the project and for 12 months following Substantial Completion.

vii. Provide 3 hard copies of the Operations and Maintenance Manual for the Equipment and an electronic copy in .pdf format.

5. GENERAL CONTRACT CONDITIONS

A. Precedence of Terms: In the event there is a conflict between the general contract conditions and any special terms and conditions which may be included in this solicitation for use in a particular procurement, the special terms and conditions shall apply.

B. Valid Contract: The extent and character of the services to be performed by the Provider shall be subject to the general control and approval of DPU Director, or his authorized representative. Any change to the Contract must be approved in writing by the DPU Director and the Provider.

C. Changes, Additions, Deletions: No changes, additions, deletions or substitutions of Contract Terms and Conditions, Specifications, Quantity, Unit of Issue, Delivery Date, Delivery Charges, or Price will be permitted without the written approval of the DPU Director.

D. Debarment Status: By submitting their proposals, Providers certify that they are not currently debarred by the Commonwealth of Virginia from submitting bids on contracts for the type of goods and/or services covered by this solicitation, nor are they an agent of any person or entity that is currently so debarred.

E. Antitrust: By entering into a contract, the Provider conveys, sells, assigns and transfers to DPU all rights, title and interest in and to all causes of action it may now have or hereafter acquire under the antitrust laws of the United States of America and the Commonwealth of Virginia, relating to the particular goods or services purchased or acquired by DPU under said contract.

F. Insurance: The Provider shall provide and maintain the following minimum limits of insurance coverage during the period of performance required under this Contract.

1) Comprehensive General Liability

   a. $1,000,000 Bodily Injury and Property Damage per occurrence and aggregate

   b. Comprehensive General Form

   c. Extended Business Liability Endorsement

   d. Independent Contractors Coverage

   e. Products/Completed Operations (to be provided for a minimum of 36 months after completion of the work)

   f. Broad Form Contractual Liability

   g. Personal Injury Liability

2) Comprehensive Automobile Liability

   a. $1,000,000 Combined Single Limits

   b. Statutory Uninsured Motorist Coverage

   c. Hired and Non-owned Coverage

   d. Motor Carrier Act Endorsement

3) Workers Compensation and Employer's Liability

a. Statutory Coverage for Virginia

b. $1,000,000 Employer's Liability

c. Broad Form All States Endorsement

d. Compliance with all Federal Statutes, including U.S. Longshoreman and Harbor Worker's Act, the Jones Act, and Federal Employees Act.

4) Umbrella Liability

1) Additional $1,000,000 liability coverage over the primary limits for Comprehensive General Liability, Comprehensive Automobile Liability and the Employer's Liability

Prior to commencing work under the Contract, the successful Provider shall furnish DPU with a Certificate of Insurance naming DPU as an additional insured endorsed by insurance company licensed to provide insurance services in the Commonwealth of Virginia.

G. SCC Licensing: Corporations conducting business within the Commonwealth of Virginia must be incorporated in the Commonwealth of Virginia or present certification as issued by the Virginia State Corporation Commission and shall complete the attached SCC certification form and submit it with the proposal, (See Attachment A3).

H. Hold Harmless Clause: The Provider shall, during the term of the Contract including any warranty period, indemnify, defend, and hold harmless DPU, its officials, employees, agents, and representatives thereof from all suits, actions, or claims of any kind, including attorney's fees, brought on account of any personal injuries, damages, or violations of rights, sustained by any person or property in consequence of any neglect in safeguarding contract work or on account of any act or omission by the Provider or his/her employees, or from any claims or amounts arising from violation of any law, bylaw, ordinance, regulation or decree. The Provider agrees that this clause shall include claims involving infringement of patent or copyright.

I. Employees Not to Benefit: As a prerequisite for payment pursuant to the terms of this Contract, there shall be furnished to DPU a statement that no employee of DPU, or members of the immediate family, including spouse, parents or children has received or has been promised, directly or indirectly, any financial benefit by way of fee, commission, finder's fee or in any other manner, remuneration arising from or directly or indirectly related to this Contract.

J. Public Inspection of Procurement Records: Proposals submitted shall be subject to public inspection in accordance with *Virginia Code* §2.2-4342.

K. Proprietary Information: Bids or proposals containing trade secrets or proprietary information submitted by a bidder, Provider, offeror or contractor in connection with a procurement transaction shall not be subject to public disclosure under the Virginia Freedom of information Act; however, the bidder, Provider, offeror or contractor must invoke the protection of this section prior to or upon submission of the data or other materials, and must identify the data or other materials to be protected and state the reasons why protection is necessary for each section. Claim of trade secrets or proprietary information for the entire bid is not permissible, (See Attachment A2).

L. Samples: Samples, when required in the specifications, shall be delivered to the Executive Director at the Provider's/offeror's/bidder's expense by the date and time specified in the bid documents; said time is in no case shall be later than the bid opening. Samples shall be removed by the Provider/offeror/bidder at his/her own expense within 30 (thirty) days after written notice to do so. Failure to do so may result in storage of the property at the Provider's/offeror's/bidder's risk and expense, or declaration as abandoned property and subject to disposal as such.

M. Brand Names/Catalog References: Any catalog, brand name, or manufacturer's reference used in bid invitation is descriptive, not restrictive and shall be deemed to indicate " or approved equal" whether or not so state, unless justification by reason of sole source or emergency condition (e.g. repair parts, etc.) is specifically cited. Proposals/Bids on brands of like nature and quality will be considered, provided the Provider/offeror/ bidder submits a complete description of same and notes any and all reference numbers. Otherwise, it shall be understood that the specified brand will be furnished. Equality of the like nature items shall be determined by DPU. In such instances, the judgment of DPU is final. Exception to this "or approved equal" clause will be made if the bid calls for prequalification of products. In this case, only those brands and models cited in the bid documents, or those otherwise pre-qualified as set forth in said document, will be considered.

N. Ownership of Material: Ownership of all data, material and documentation originated and prepared for DPU, including any electronic media, shall belong exclusively to DPU and be subject to public inspection in accordance with the Virginia Freedom of Information Act.

O. Applicable Laws and Courts: This solicitation and any resulting contract shall be governed in all respects by the laws of the Commonwealth of Virginia and any litigation with respect thereto shall be brought in the Courts of Rockingham County, Virginia. The Provider shall be in compliance with all of the laws of the Commonwealth of Virginia, all ordinances and laws of Rockingham County and such other standards, codes, and regulations having application to the goods or services provided.

P. Exemption from Taxes: DPU is exempt from State and Federal Taxes. A Tax Exemption Certificate indicating DPU's tax exempt status will be furnished upon request.

Q. Substitutions: No substitutions, including key personnel or cancellations are permitted after Contract award without the written approval of the DPU Director.

R. New Goods, Fresh Stock: Unless otherwise specifically stated, the Provider shall provide new rather than used goods, fresh stock and the latest model, version, design or pack of any item specified.

S. Price Currency: Unless stated otherwise in the solicitation, Providers/offerors/bidders shall state prices in US dollars.

T. Assignment of Contract: This Contract may not be assigned in whole or in part without the written consent of the DPU Director as outlined in the City's General Contract Terms and Conditions.

U. Default: In case of failure to deliver goods or services, the City's General Contract Terms and Conditions shall be applied.

V. Termination: Subject to the provisions below, the Contract may be terminated by DPU upon sixty (60) days advance written notice to the other party; but if any work or service hereunder is in progress, but not completed as of the date of termination, then this Contract may be extended upon written approval of DPU until said work or services are completed and accepted.

W. Termination for Convenience: In the event that this Contract is terminated or canceled upon request and for the convenience of DPU, without the required sixty (60) days advance notice, then DPU shall negotiate reasonable termination costs, if applicable.

X. Termination for Cause: Termination by DPU for cause, default or negligence on the part of the Provider shall be excluded from the foregoing provision; termination costs, if any, shall not apply. The sixty (60) days advance notice requirement is waived in the event of Termination for Cause.

6. Special Terms and Conditions

A. Definition of Terms: The terms "Manufacturer/Supplier" or "Provider" as used in this RFP shall refer to the Provider for Scope of Services specified herein including any manufacturers, suppliers or subcontractors utilized to furnish the Equipment specified. The term "Installing Contractor" as used in the RFP shall refer to a separate party contracted by DPU to install the Equipment provided under this RFP.

B. Performance and Payment Bonds: A performance and payment bond in the amount of one hundred percent (100%) of the estimated value of the Contract shall be required of the successful Provider. These bonds shall be in a form acceptable to DPU and executed by a Surety duly authorized to do business in the Commonwealth of Virginia.

C. Retainage: Under the provisions of *Code of Virginia* §2.2-4333, the Provider shall be paid at least ninety-five percent of the earned sum when payment is due, with no more than five percent being retained to ensure faithful performance of the Contract. All amounts withheld may be included in the Final Payment. Any subcontract for a public project that provides for similar progress payments shall be subject to the provisions of this section. The Provider may request release of retainage for any portion of the Work completed and accepted provided, however, that adequate progress is being made and DPU approves such release.

D. Partial Payment: DPU will pay the Provider percentages of the contract price according to the following schedule:

1) 10% within 30 days of delivery of shop drawings to DPU.

2) 40% (50% cumulative) within 30 days of delivery of the Equipment to the Water Operations Center, Central Stores, 2111 Beery Road, Harrisonburg, VA.

3) 30% (80% cumulative) within 30 days of DPU issuing a certificate/letter of Substantial Completion for the Equipment. DPU will conduct a substantial completion inspection when the Provider notifies DPU that ALL of the following has been successfully achieved/performed in accordance with the contract documents:

   a. Provider's issuance of Certificate of Proper Installation to DPU for all equipment;

   b. Provider's issuance of Certificate of Proper Operation to DPU for all equipment;

   c. Provider's successful completion of all start-up activities, field performance testing and submission of said documentation to DPU.

E. Final Payment: The final payment, which will include the retainage, less any amounts due or claimed by DPU, shall not become due until all punch list items have been resolved to the satisfaction of DPU and after the Provider has conducted all training and has delivered all documents as described in the Specifications. Within 30 days of completion of said items, DPU shall pay the Provider the amount therein stated, less all prior partial payments.

7. Instructions for Preparing and Submitting Proposals

A. Questions and Inquiries: Procedural questions about this RFP should be in writing and directed to: Pat Hilliard, Purchasing Agent at Purchasing@harrisonburgva.gov. Technical questions should be directed in writing to Mike Collins, Director of Utilities at mcollins@harrisonburgva.gov. All relevant questions will be answered by written addendum to www.harrisonburgva.gov/bids and on the State of VA purchasing webpage at www.eva.virginia.gov. All questions must be submitted in writing a minimum of seven calendar days prior to solicitation due date in order to be considered).

B. Mandatory Pre-Proposal Meeting: A mandatory pre-proposal conference will be held for this solicitation on December 18, at 10:00 am at the North River Pump Station. The scope, contents and delivery of this proposal will be discussed at that time. If any Provider would like to request a time other than the pre-proposal meeting to conduct an additional site visit, those visits may be scheduled during or after the scheduled pre-proposal meeting.

C. Contents of Proposals: Information contained in the proposal shall be stated in a clear and concise manner specific to the product being offered and the specifications outlined herein.

D. The Provider's submittal shall be organized in accordance with the following Table of Contents. Each page of the submission should be numbered sequentially.

1) Table of Contents

Section	Title
1	Executive Summary
2	Manufacturer Information, Relevant Experience and References
3	Guaranteed Delivery Schedule within 90 days of order date
4	Response to RFP Technical Requirements
5	Vendor Identification/Ownership Disclosure Statement
6	Price Quotation Form

2) Executive Summary

a. Provide an executive summary highlighting key aspects of the proposal excluding cost information.

b. The executive summary should not exceed one page in length.

c. The executive summary shall clearly state and identify who the sole responsible party is for submitting the proposal. There shall only be one responsible party/Provider.

3) Manufacturer Information, Relevant Experience and References

a. The Manufacturer is defined as the party that actually manufacturers the VFDs and Electrical Gear.

b. Identify the location of the corporate headquarters and the location of the facility where the equipment will be manufactured for this project.

c. Identify the Project Manager, Applications Engineer and Field Representativethat will be assigned to this project. Provide brief descriptions of their experience and qualifications.

d. As part of cost proposal, include a recommended six-month supply of all consumables as required for continuous operation of the Equipment (oil, lubricants, etc.).

e. As part of cost proposal, include all special tools required for routine and preventative maintenance.

f. Provide a brief company history detailing product lines and history of manufacturing equipment meeting the requirements of this RFP.

g. List all professional and technical certifications/affiliations.

h. Description of company structure and identify and outline any and all relationships with any partners, equipment suppliers and/or consultants that would be used for this project.

i. Location of nearest authorized Field Representative and the source and location of origin for spare parts for the Equipment. Provide legal name, address and contact person for the authorized service representative(s). Provide the number of trained service technicians employed by the service representative.

j. Describe the customary technical support provided after the completion of the contractual warranty period.

k. Provide a list of recommended spare parts for DPU to retain on-site and include in cost proposal.

l. Demonstrate a minimum of twenty (20) project references demonstrating relevant experience in the manufacture and installation of the exact model or equivalent (larger) VFD for vertical turbine pumping applications for drinking water or raw water supply for a public drinking water source. Provide references showing relevant experience in the last ten (10) years with a description of each contract, dates, and delineation of specific equipment provided.

m. Demonstrate a minimum of twenty (20) project references demonstrating relevant experience in vibration analysis substantially similar to that required in the RFP for the exact model or equivalent (larger) VFD for vertical turbine pumping applications for drinking water or raw water supply for a public drinking water source. Provide references showing relevant experience in the last ten (10) years with a description of each contract, dates, and delineation of specific equipment provided.

n. Provide Owner and Operator contacts for the references/installations listed above. Contact names and telephone numbers are to be provided for all references.

o. State the motor horsepower provided for all references/installations listed above.

4) Guaranteed Schedule

a. Provider shall provide a guaranteed schedule from issuance of PO to delivery of Equipment to DPU and fulfillment of all procurement terms and conditions.

b. Delivery of three (3) hard copies of the O&M manual and an electronic copy in PDF format is a requirement in meeting the equipment delivery schedule requirements to the job site.

E. The Price Quotation Form shall contain the following items:

1) The base price for the Equipment to achieve the performance requirements listed in the RFP.

2) Include additive option cost for providing an extended warranty from 24 months to 36 months from start-up.

3) If applicable, add or deduct pricing for any other suggested alternate equipment and or accessories.

F. Proposal Submission Procedure

1) Proposals must be received at the City of Harrisonburg, Purchasing Department 345 South Main Street, Room 201, Harrisonburg, VA 22801 BEFORE 2:30 P.M., Local Prevailing Time, January 15, 2014.

2) Each proposal shall be submitted in a sealed envelope with the outside of the envelope stating the name of the Provider, return mail address, telephone number and the following identification: "RFP No. 2014015-PU-P: NORTH RIVER PUMP STATION VFDS AND ELECTRICAL GEAR".

3) Provide an electronic copy of proposal in portable document format (PDF) with 5 copies of original proposal. Faxed or e-mailed proposals will not be accepted. Proposals received after the appointed acceptance date and time will not be accepted. It is the sole responsibility of the bidder to ensure their proposal arrives on time. The City of Harrisonburg will not be responsible for any delays.

4) Providers, prospective bidders, vendors or other interested parties requiring "reasonable accommodation" under the Americans with Disabilities Act for submission of proposals, authorized inspection visits or appropriate data collection on DPU property, or any other procurement-related contact with DPU staff, must contact the DPU Director in a timely manner to arrange such accommodations as appropriate.

H. DPU to Bind Firm in Contract: Proposals must give the full name and address of the vendor. Failure to manually sign the Proposal may disqualify it. The person signing the Proposal shall show Title or Authority to bind his/her firm in a contract.

I. Rights of DPU: DPU reserves the right to accept or reject all or any part of any proposal, waive informalities and award the Contract to best serve the interest of DPU.

J. The contents of the Proposal submitted by the successful Provider and this RFP will become part of any contract/PO awarded as a result of the Scope of Work contained herein.

K. Costs of Proposal Preparation: Any costs incurred by the Providers in preparing or submitting proposals are the Provider's responsibility. DPU will not reimburse any Provider for any costs incurred as a result of a response to this RFP.

L. Addendum and Supplement to Request: Only written communications relative to this procurement will be considered. No oral communication by either the Provider or any representative of DPU shall alter or amend the intention of these specifications or be binding thereupon. Written addenda will be issued for any clarifications and or changes necessitated by appropriately posed questions from potential Providers and /or representatives of DPU. Written acknowledgement of all addenda is necessary for the bid to be considered complete and responsive. Addenda will be posted on the City web site www.harrisonburgva.gov/bids and the State of VA purchasing web site at www.eva.virginia.gov. It is the responsibility of the proposer to obtain all addenda information before submitting their proposal Any and all Addenda must be signed and returned as part of the proposal.

8. Evaluation of Proposals

A. DPU will review and rank the proposals from each Provider based upon the factors itemized below. Weighting factors will be applied to each category.

1) Quality Factors

a. Relevant Manufacturer experience and performance track-record. (15%)

b. Compliance with all aspects of the RFP (20%)

c. Demonstrated Quality Assurance/ Quality Control (QA/QC) (10%)

d. Guaranteed delivery schedule (20%)

e. Ease of integration with existing generator (10%)

2) Cost Factors

f. Equipment Cost (25%)

B. Each proposal will be evaluated with respect to compliance with all technical and administrative requirements as detailed in the RFP.

C. References will be evaluated based on the similarity of the installation as well as comments received from the reference.

D. QA/QC will be evaluated based on the Provider's QA/QC program and ISO certification(s).

E. Selection shall be made of two or more offerers deemed fully qualified and best suited among those submitting proposals on the basis of the factors outlined in this request for proposals, including price. Negotiations shall then be conducted with each of the offerers so selected. Prices shall be considered, but need not be the sole determining factor. After negotiations have been conducted with each offeror so selected, the purchasing agent shall select the offeror which in the City's opinion has made the best proposal and shall award the contract to that offeror. Should the purchasing agent determine in writing an in his or her sole discretion that only one offeror is fully qualified, or that one offeror is clearly more highly qualified than the others under consideration, a contract may be negotiated and awarded to that offeror.

F. DPU reserves the right to not award/select any proposal at its sole discretion. DPU may choose to award based solely upon the base bid or any combination of base bid and additive/deductive alternates at DPU's sole discretion.

G. Should DPU determine in writing and in its sole discretion that only one Provider is fully qualified, or that one Provider is clearly more highly qualified than the others under consideration, a contract may be negotiated and awarded to that Provider.

H. From the date that the proposals are due, DPU will have 90 days to issue Notice of Award to the Manufacturer/Supplier for the Equipment. A written notice of award shall be provided to the successful Provider within the specified acceptance period.

I. Notice of Award: DPU will provide public notice announcing its decision to award the contract by posting the Notice of Intent to Award on the the City of Harrisonburg's Purchasing web page at: (www.harrisonburg.va.bids; and on the *eVA* website (http://eva.virginia.gov/).

9. Price Quotation Form

NORTH RIVER PUMP STATION VFDS AND ELECTRICAL GEAR

RFP No. 2014015-PU-P

Item #	Description	Price
1	VFD and Electrical Gear Equipment	$
Additional Optional Add/(Deduct) Items		Price
AD-1	Add Item: 36 Month Warranty	$
AD-2	Daily Rate - Field Representative	

Note: Prices are to include all charges, F.O.B. delivery site at Central Stores, 2111 Beery Road, Harrisonburg Virginia. Exceptions to specification listed in the Scope of Services, if any, shall be enumerated below:

_____

_____

_____

_____

_____

_____

By: _____

(Business Name)

_____

(Name and signature of person authorized to sign)

_____

(Title of person authorized to sign)

10. Vendor Identification and Ownership Disclosure

NORTH RIVER PUMP STATION VFDS AND ELECTRICAL GEAR

RFP No. 2014015-PU-P

Company:					
Address:					
Contact Person:					
Telephone:		Fax:		E-Mail:	
Organized under the laws of the State of:					
Principal place of business:					
Following list includes persons having ownership of 3% or more in the company (attach more sheets if necessary):					
Name			**Address**		

DPU requests that any consultant, firm or vendor receiving a contract of award resulting from an RFP issued by DPU shall make certification as specified below. Receipt of such certification, shall be a prerequisite to the award of contract and payment thereof.

Section II – Employees Not to Benefit

I (we) hereby certify that if the contract is awarded to our firm, partnership, or corporation, that no employees of DPU or members of his/her immediate family, including spouse, parents or children has received or been promised, directly or indirectly, any financial benefit, by way of fee, commission, finder's fee, political contribution or any similar form of remuneration on account of the act of awarding and/or executing this contract.

Section III – Conflicts of Interest

This solicitation is subject to the provisions of VA Code §2.1-639.2 et. seq, the State and Local Government Conflict of Interests Act. The Vendor [ ] is [ ] is not aware of any information bearing on the existence of any potential organizational conflict of interest.

Section IV – Collusion

I certify that this offer is made without prior understanding, agreement, or connection with any corporation, firm, or person submitting an offer for the same services, materials, supplies, or equipment and is in all respects fair and without collusion or fraud. I understand collusive bidding is a violation of the State and Federal law and can result in fines, prison sentences, and civil damages.

I hereby certify that the responses to the above representations, certifications, and other statements are accurate and complete. I agree to abide by all condition of this RFP and certify that I am authorized to sign for my company.

Signature: _____ **Date:** _____

Print: _____ **Title:** _____

NORTH RIVER PUMP STATION VFDS AND ELECTRICAL GEAR

RFP No. 2014015-PU-P

ATTACHMENT A1:

TECHNICAL SPECIFICATIONS

NORTH RIVER PUMP STATION VFDS AND ELECTRICAL GEAR

RFP No. 2014-015-PU-P

ATTACHMENT A1:

TECHNICAL SPECIFICATIONS

Note:

Equipment/Building electrical Installation specifications provided for reference as required to configure VFDs and Electrical Gear to be compatible with pump station installation.

Final required VFD and equipment configuration to be confirmed during shop drawing review in coordination with building system electrical installation drawings to be provided upon selection of preferred vendor.

SECTION 262923 - ENCLOSED VARIABLE FREQUENCY DRIVES (1 to 500 HP)

PART 1 - PART 1 GENERAL

1.1 SCOPE OF WORK

A. Furnish variable frequency drives (VFDs) for mechanical equipment as scheduled on the drawings and specified herein. The term VFD shall refer to the entire assembly including but not limited to the inverter, circuit-breakers, transformers, bypass contactors, reactors, filters, controllers and wiring.

B. The VFD's shall comply with the latest applicable standards of ANSI, IEEE, NEMA, NEC, and UL. The controllers shall be rated as indicated. As a minimum, the full load output current of the drive shall be equal to the equivalent motor horsepower as listed by NEC Table 430-150. The VFD manufacturer shall furnish, field test, adjust and certify all installed VFDs for satisfactory operation.

C. VFD minimum rating shall be 400 horsepower (HP). The rating shall be coordinated to be completely compatible with performance requirements of the motor and pump to be driven for the selected motor and pump manufacturers. NRPS motors to be driven by the VFDs procured on this contract will be 400 HP, 480V, 3 PH, 60Hz premium-efficiency, vertical hollow-shaft motors, procured separately on Contract 3, motor vendor has not been selected at this time.

D. VFDs shall be constructed to UL 508A using UL recognized components assembled in a UL listed enclosure in strict accordance with the NEC for electrical safety. In addition the entire VFD assembly shall be listed to UL 508A with a Short Circuit Current Rating (SCCR) as specified.

E. All VFDs on the project shall be the product of a single manufacturer.

F. Any exceptions/deviations to this specification shall be indicated in writing to the specifying engineer and submitted with the quotation.

1.2 REFERENCES

General: Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section, and are hereby incorporated into, and made a part of the Contract Documents.

A. NFPA-70 (2002) “National Electric Code (NEC®)”

B. ANSI C84.1 (R2002) “Electric Power Systems and Equipment - Voltage Ratings (60Hz)”

C. UL508A (2003) “Standard for Safety for Industrial Control Panels”

D. UL508C (2002) “Standard for Safety for Power Conversion Equipment”

E. NFPA 79 (2002) “Electrical Equipment of Industrial Machines/Industrial Machinery

F. NEMA ICS7 (2000) “Industrial Control and Systems: Adjustable Speed Drives

G. NEMA ICS7.1 (2000) “Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems

H. NEMA 250 (1997) “Enclosures for Electrical Equipment (1000V maximum

I. IEC 61800-2 (1998-03) “Adjustable speed electrical power drive systems - Part 2: General requirements - rating specifications for low voltage adjustable frequency AC power drive systems”

J. IEC 61800-3 (1998-06) “Adjustable speed electrical power drive systems - Part 3: EMC product standard including specific test methods”

K. IEC 61800-5-1 (2003-02) “Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy

L. IEC 61800-6 (2003-03) "Adjustable speed electrical power drive systems - Part 6: Guide for determination of types of load duty and corresponding current ratings.”

M. EGSA 101P (1995a) “Engine Driven Generator Sets - Performance Standard”

N. IEEE 519 (1992) “Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems”

1.3 SUBMITTALS

A. Six (6) copies of approval drawings shall be furnished for Engineer’s approval prior to factory assembly of the VFDs. These drawings shall consist of elementary power and control wiring diagrams and enclosure outline drawings. The enclosure drawings shall include front and side views of the enclosures with overall dimensions and weights shown, conduit entrance locations and nameplate legend details.

B. Standard catalog sheets showing voltage, horsepower, maximum current ratings and recommended replacement parts with part numbers shall be furnished for each different horsepower rated VFD provided.

C. Harmonic calculation study for entire project to include the following:

1. List of all drives on the project (not limited to HV VFDs)
2. Simplified building one line diagram indicating linear loads as well as drives, transformers and Point of Common Connection (PCC).
3. Technical description of the computing software used for the calculations.
4. Description of all inputs and outputs from the analysis.

1.4 WARRANTY

A. The Provider shall provide a full written warranty for all equipment provided under this RFP. The warranty period shall be 24 months from start-up but not to exceed 30 months after the date of Substantial Completion. If a defect is found during the warranty period, the Provider shall remedy said defect at no cost to DPU. The Provider shall provide a cost adder for extending the warranty for all equipment to 36 months from start-up but not to exceed 48 months after the date of Substantial Completion.

B. Manufacturers shall provide guarantees for work under this Contract. However, such guarantees shall be in addition to and not in lieu of all other liabilities which the manufacturer may have by Law or by other provisions of the Contract Documents.

C. All materials, items of equipment and workmanship furnished under each Section shall carry the standard warranty against all defects in material and workmanship. Any fault

due to defective or improper material, equipment, workmanship or design which may develop shall be made good, forthwith, by and at the expense of the Contractor including all other damage done to areas, materials and other systems resulting from this failure.

D. The Contractor shall guarantee that all elements of the systems provided under his Contract, are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.

E. Upon receipt of notice from the Owner's representative of failure of any part of the systems or equipment during the warranty period, the affected part or parts shall be replaced, within three (3) working days, at no cost to the Owner.

F. The performance requirements of the VFD shall be verified by field testing described herein before the final payment is made. This shall include proper integration with remote logic controls (SCADA/PLC) interface, VFD input/output/control requirements shown on building modification drawings, Installing Contract (Contract 1).

1.5 QUALITY ASSURANCE AND FACTORY TEST

A. The manufacturer of the VFD shall be a certified ISO 9001 facility.

B. The VFD and all associated optional equipment shall be UL LISTED according to UL 508A. A UL label shall be attached inside each enclosure as verification.

C. The VFD shall be designed constructed and tested in accordance with NEMA, NEC, VDE, IEC standards.

D. Every power converter shall be tested with an actual ac induction motor, 100% load and temperature cycled within an environmental chamber at 104° F. Documentation shall be furnished to verify successful completion at the request of the engineer.

E. All printed circuit boards shall be tested under a temperature cycling (-20 to +65°C) then functionally tested via fault finder bench equipment prior to unit installation.

F. All Drive door mounted pilot devices shall be tested to verify successful operation. Documentation shall be furnished upon written request of the engineer.

G. All final assemblies shall be tested at full load. Additional testing of line-to-line and line-to-ground bolted faults shall be conducted if the drive controller design can not be Certified by UL 508C as applied to NEMA ICS 7.1 Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems. The VFD shall trip electronically without device failure

H. After all tests have been performed, each VFD shall undergo a 6-hour Factory burn-in at full load test if Six Sigma Quality and Reliability are not pre approved in advance of receiving quotations for drive under this contract specification. The drive shall be burned-in at 100% inductive or motor load for (6) hours at full load without an unscheduled shutdown. When Factory burn in is not provided the drive supplier will prove 12 months of additional warranty.

PART 2 - PRODUCTS

2.1 VARIABLE FREQUENCY DRIVES

A. General

1. Provide each complete variable frequency drive (VFD) in a single enclosure, with capacity, quantity and characteristics as described in this specification and as shown and scheduled on the drawings.

   a. The vectorial sum of the harmonic currents of all three (3) VFDs shall comply with IEEE 519 for THID and shall produces less than 3% THVD < 3% at of the points of common connection (PCC) including the switchboard and panels within the 480Vac distribution system. Acceptable manufacturers shall prove this requirement by analysis and during field verification testing prior to receiving final payment.

2. All VFDs shall be of the same manufacturer.

3. Each drive and assembly (with or without isolation bypasses) shall be U.L. listed and labeled.

   a. Label shall include the AIC rating for the assembly (SSCR) in accordance with UL 508A Sub-part B standard, which shall not be less then 65,000 AIC.

   b. Any unit shipped without such label shall be removed from the job with NO EXCEPTIONS.

4. Each drive shall be mounted with it's accessories in a single enclosure.

5. Installation and start-up services for the equipment shall be covered by this specification.

6. Input and output control signal shall be compatible with automatic controls and/or building automation control system provided under Division 25. Submit written, signed off coordination with submittal.

7. Complete drawings shall be furnished and approved before proceeding with manufacture. Drawings shall consist of a specific bill of materials, connection diagrams and suitable outline drawings showing details necessary to locate conduit stub-ups and field wiring.

8. The VFD shall comply with the latest applicable standards of ANSI, IEEE and NEMA. The controllers shall be rated as shown in the drawings. As a minimum, the full load output current of the drive shall be equal to the equivalent motor horsepower as listed by NEC Table 430-150.

9. Drive horsepower shall be minimum size as indicated. Coordinate size with driven equipment manufacturer.

10. The VFD manufacturer shall supply with submittal information, harmonic calculations made in accordance with IEEE 519-1992 Standards showing the specified THVD, line notching and the specified THCD limits are met. Calculations shall assume worst case system conditions. System 1-line, 480V transformer data, standby generator data, and primary fault current data required to make these calculations are provided in the system short circuit study and can be obtained from the Division 26 Electrical Contractor. The submittal shall

include, as a minimum, the following information if independent performance test results are not provided in advance. See Section (2.01 C.).

a. All input data and assumptions.

b. Explanation of method uses to perform the analysis.

c. All calculation and computer printout used tin the analysis including input documentation.

1) List all drives and accessories

2) Explanation of all inputs

3) Explanation of all outputs

d. A system impedance diagram based on the electrical one-line diagrams. It shall be the drive manufactures responsibility to obtain all information required.

e. All calculations shall be in accordance with IEEE 519 with all drives at 100% speed. The point of common coupling shall be the secondary connection of the transformer supplying that group of devices. These calculations shall be done with the transformer loaded to no more than 70% of its nominal capacity (without fans). These calculations shall also be done with all 18-pulse drives running

f. Each point of common coupling shall be defined as the secondary side of the transformer that feeds that group of drives. At the point of common coupling, the following numbers shall meet with the maximum load on the transformer no greater than 70% of its nominal capacity as well as the smaller drives running

1) Total harmonic voltage distortion is less than 3%

2) Total harmonic current distortion is less than 5% and harmonic table requirements ISC/IL <20

g. A detailed description of the tests, procedures and supporting calculations required to substantiate the installed systems compliance with the specified THD limits.

1) The description shall include information on the proposed test equipment and test conditions

2) Include the name and qualifications of the firm which will conduct the field tests

h. Submittals without calculations will not be reviewed.

i. Drives shall be capable of the full rated motor horsepower at all carrier frequencies of that drive.

B. Construction requirements for harmonic mitigation

1. VFDs 125 HP and Larger

a. VFDs 125 HP and larger shall be IEEE 519 DRIVE TERMINAL COMPLIANT using MTE Matrix Harmonic Filters (Series D) or 18-pulse with phase shifting transformer and phase balancing reactor Technology. Provide data and calculations showing the drive

harmonics do not exceed the following numbers at the power connection to the drive.

1) Total harmonic voltage distortion: Less than 3%

2) Total harmonic current distortion: Less than 5% and harmonic table requirements for ISC/IL < 20.
Note: These are the maximum harmonics that can be generated by each of these drives

b. The full load efficiency of the harmonic filter or the 18-pulse VFD shall be greater than 98 percent.

c. All wiring for the harmonic filter or 18-pulse transformer shall be copper.

C. Harmonic Mitigation Performance and Efficiency Certification

a. Harmonic Mitigation Performance and Energy Efficiency Certification shall be provided by an independent test lab as recognized by the Department Of Energy.

b. Validated test data shall be submitted using a test dynamometer to provide motor loading at Full Load, ¾ Load, ½ Loads. Test data must be provided using a dynamometer to control motor loading. The VFD shall remain running a 60 HZ output for all load conditions.

1) Harmonic measurement must be taken for phase unbalance condition of 2%, 3%, 4% and 5%

c. Without certification proposals shall be evaluated using a default efficiency value. The difference will be used to calculate saving over a 5 year operation period and added to equipment price to determine best customer value.

d. The Client will engage an independent testing company to perform harmonic testing of the VFDs in the system. The harmonic testing will provide readings with printouts of the harmonic current at each harmonic as well as the total voltage distortion at the points of common connection. The final payment to manufacturer shall depend on the verification of meeting all technical specifications including the comprehensive test report of harmonic mitigation performance as a function of load, and frequency unbalance. The report will also show motor and system efficiency as a function of load.

2.2 PERFORMANCE AND EXECUTION

A. Field Commissioning, Training and Warranty Service

a. Per RFP

2.3 CONSTRUCTION REQUIREMENTS FOR ALL VFDS

A. VFDs shall be supplied in floor mounted enclosures.

B. The VFD shall be mounted in a Type 1 enclosures with an external operated disconnect device. NEMA Type 12 or Type 1G ventilated enclosures with gaskets and filters are acceptable.

C. A mechanical interlock shall prevent personnel from opening the VFD door when the disconnect is in the "ON" position. It shall be possible for authorized personnel to defeat this interlock. Provisions shall be provided for locking all disconnects in the off position with up to three padlocks. Provisions shall also be made for accepting a padlock on the circuit breaker disconnect, preventing movement of the disconnect to the "ON" position when the door is open.

D. Provisions shall be made for both top and bottom conduit entry.

E. All fans within an enclosed VFD including the VFD heat sink fans shall be front accessible and removable without removal the VFD power converter to facilitate maintenance and or fan replacement.

F. Control wiring shall have permanent wire markings on the wire insulation. Both ends of the control wiring shall contain wire markings per the as built control elementary diagram. Red control wiring shall be used for 115Vac control circuits and blue control wiring shall be used for 24V control circuits.

G. All VFD enclosures shall be painted ANSI 61 Gray. The enclosure interior shall include a mounting surface for control and power component mounting.

2.4 ENVIRONMENTAL RATINGS

A. The VFD shall be of construction that allows operation in a pollution Degree 3 environment. The VFD shall meet IEC 60664-1 and NEMA ICS 1 Standards. The VFD shall be designed to operate in an ambient temperature from 0 to + 40 °C (+32 to 104 °F).

B. The storage temperature range shall be -25 to + 70 °C.

C. The maximum relative humidity shall be 95% at 40 °C, non-condensing.

D. The VFD shall be rated to operate at altitudes less than or equal to 3,300 ft (1000 m). For altitudes above 3,300 ft, de-rate the VFD by 1.2% for every 300 ft (100 m).

E. The VFD shall meet the IEC 60068-2 Operational Vibration Specification.

2.5 RATINGS

A. The VFD shall be designed to operate from an input voltage of and 460 ± 10% Vac.

B. The VFD shall operate from an input voltage frequency range of 60 Hz ± 5%.

C. The displacement power factor shall not be less than .95 lagging under any speed or load condition.

D. The efficiency of the VFD at 100% speed and load shall not be less than 96%.

E. Variable torque rated VFDs shall have an overcurrent capacity shall be 110% for one minute. Constant torque applications (when specified or indicated on drawings) shall use rated VFDs for an overcurrent capacity of 150% for one minute.

F. The output carrier frequency of the VFD shall be randomly modulated and selectable at 2, 4, or 10 kHz depending on Drive rating for low noise operation.

G. The maximum output frequency will be 200 Hz or as compatible with the driven equipment.

H. The VFD will be able to develop rated motor torque at 0.5 Hz (60 Hz base) in a sensorless flux vector (SVC) mode using a standard induction motor without an encoder feedback signal.

2.6 PROTECTION

A. Circuit breaker coordination and short circuit protection shall be used. The use of semiconductor or current limiting fuses will not be approved.

B. The drive controller shall be UL 508C listed for use on distribution systems with 65,000 A available fault current. The drive controller shall have a coordinated short circuit rating designed to UL 508C and NEMA ICS 7.1 and listed on the nameplate. The drive controller shall be packaged with bypass (if specified or indicated on drawings) and harmonic mitigation (as specified) in accordance with UL 508A . The packaged "VFD" shall have an overall Short Circuit Current Rating (SCCR) of 100,000 A per UL 508 A.

C. Provisions shall be made to padlock the circuit breaker in the off position when the enclosure door is open.

D. Upon power-up the VFD shall automatically test for valid operation of memory, option module, loss of analog reference input, loss of communication, dynamic brake failure, DC to DC power supply, control power and the pre-charge circuit.

E. The Power Converter shall be protected against short circuits, between output phases and ground; and the logic and analog outputs.

F. The VFD shall have a minimum AC undervoltage power loss ride-through of 200 msec. The VFD shall have the user-defined option of frequency fold-back to allow motor torque production to continue to increase the duration of the powerloss ride-through.

G. The VFD shall have a selectable ride through function that will allow the logic to maintain control for a minimum of one second without faulting.

H. For a fault condition other than a ground fault, short circuit or internal fault, an auto restart function will provide up to 255 programmable restart attempts. The programmable time delay before restart attempts will range from 1 second to 999 seconds.

I. The deceleration mode of the VFD shall be programmable for normal and fault conditions. The stop modes shall include free-wheel stop, fast stop and DC injection braking.

J. Upon loss of the analog process follower reference signal, the VFD shall fault and/or operate at a user-defined speed set between software programmed speed settings or last speed.

K. The VFD shall have solid state thermal protection that is UL Listed and meets UL 508C as a Class 20 overload protection and meets IEC 947. The minimum adjustment range shall be from .25 to 1.36% of the current output of the VFD.

L. There shall be three skip frequency ranges with a bandwidth of 5 Hz. The skip frequencies shall be programmed independently, back to back or overlapping.

2.7 ADJUSTMENTS AND CONFIGURATIONS

A. The VFD shall self-configure to the main operating supply voltage and frequency. No operator adjustments will be required.

B. Upon power-up, the VFD will automatically send a signal to the connected motor and store the resulting resistance data into memory. The inductance data will be measured during no-load operation when operating at a frequency between 20-60 Hz. The VFD shall automatically optimize the operating characteristics according to the stored data.

C. The VFD will be factory pre-set to operate most common applications.

D. A choice of three types of acceleration and deceleration ramps will be available in the VFD software; linear, S curve and U curve.

E. The acceleration and deceleration ramp times shall be adjustable from 0.1 to 999.9 seconds.

F. The volts per frequency ratios shall be user selectable to meet variable torque loads, normal and high-torque machine applications.

G. The memory shall retain and record run status and fault type of a minimum of the past eight faults.

H. Slip compensation shall be a software-enabled function.

I. The software shall have a NOLD (no load) function that will reduce the voltage to the motor when selected for variable torque loads. A constant volts/Hz ratio will be maintained during acceleration. The output voltage will then automatically adjust to meet the torque requirement of the load.

J. The VFD shall offer programmable DC injection braking that will brake the AC motor by injecting DC current and creating a stationary magnetic pole in the stator. The level of current will be adjustable between 50-150% of rated current and available from 0.0-30 seconds continuously. For continuous operation after 30 seconds, the current shall be automatically reduced to 50% of the nameplate current of the motor.

K. Sequencing logic will coordinate the engage and release thresholds and time delays for the sequencing of the VFD output, mechanical actuation and DC injection braking in order to accomplish smooth starting and stopping of a mechanical process.

2.8 OPERATOR CONTROLS

A. Industrial rated 22mm type control operators and pilot devices shall be door mounted and used independently of the keypad display to select operator control modes of Communication-Auto-Off-HandHand-Off-Auto Local-Remote. A door mounted manual speed potentiometer shall be used to control speed in the Hand mode of operation.

B. Control modes shall function as follows:

1. Hand – The Hand mode shall allow manual operation of start, stop and speed control. The VFD shall start when the control operator is in the Hand mode and run and at low speed setting of the drive or higher as required by the position of the manual speed potentiometer. This mode shall function as 2-wire control and automatically restart after a power outage or auto restart after fault.

2. Off - The Off position of the control operator shall stop the VFD and prevent it from restarting while in the Off position. This position shall also reset the VFD after a fault condition has occurred.
3. Auto - The Automatic mode shall receive an auto start contact rated 115VAC to control start and stop of the VFD. This contact shall also start and stop bypass (if used) when both the Automatic mode and Bypass modes of operations are selected. In Automatic mode the user shall remotely reset the VFD by opening and closing the Auto-start contact. Speed control shall be from a customer supplied [4-20mA, 0-10Vdc] signal.
4. Comm – The communication mode shall allow start, stop and speed control over network communication. (See Communication and Network Requirements.)
5. Start-Stop – Start / Stop pushbuttons shall provide 3-wire start stop control when the drive is in the hand position. The stop push button shall only be active in the Hand mode of operation.
6. Local Remote – Local / Remote selector switch shall provide speed reference control between a manual speed potentiometer and the remote speed reference when in the Auto mode of operation.

C. The VFD shall include door-mounted “Power On”, “AFC Run”, “AFC Fault”, “Auto/Comm” mode and “Bypass” pilot lights. All pilot lights except ‘Power On” shall be Push-to-Test configurations.

2.9 VFD SEQUENCING REQUIREMENTS

A. All Enclosed VFDs shall have 115VAC interface and control sequencing. A Run Command Relay (RCR) shall function as a “request to run / run permissive” and close only when all customer wired safeties and control operator conditions calling for run are satisfied. The RCR relay shall prevent drive operation in any operating mode including network communication if the RCR relay conditions are not satisfied. A Drive Run Relay (DRR) shall provide run indication and interfacing to bypass (if used) and other system control sequencing as specified.

B. The VFD shall provide a means to limit its output power level to an adjustable preset level of 50-90% of rated output power in 1% increments while an external dry contact is closed to indicate the VFD is being supplied by standby generator power.

C. The VFD shall provide interlock logic to prevent more than one VFD from running at the same time while being supplied by standby generator power.

2.10 SYSTEM CONTROL AND INTERFACE REQUIREMENTS

A. The following additional controls and interface requirements shall be provided:

1. Auxiliary Contacts – The VFD shall provide the following auxiliary contacts to indicate the following conditions:

   2 N.O. contacts to indicate DRIVE RUN

   1 N.C. contact to indicate DRIVE RUN

   1 N.O. contact to indicate DRIVE FAULT

   2 N.C. contacts to indicate DRIVE FAULT

1 N.O. contact to indicate BYPASS RUN

1 N.O. contact to indicate AUTO/COMM MODE

2.11 COMMUNICATION AND NETWORKING REQUIREMENTS

A. A Communication Mode Relay (CMR) shall close when operator controls are in the communication position. Contacts from the CMR relay shall pick up the run command relay if all safety conditions are met. Contacts from the CMR relay shall also provide pilot light indication when the VFD is in the communication mode. The CMR relay shall allow monitoring using network communication in any operator control mode. Network communication of start, stop, and speed control shall be limited to the communication mode when operator controls are in the communication position.

B. The following Ethernet TCP/IP communication card and protocol shall be mounted and wired within the enclosed VFD.

C. The VFD shall accept an Ethernet communications card that includes embedded web-pages.

1. The embedded web-pages shall provide the ability to configure, control, monitor and diagnose the VFDs via a standard web-browser such as Internet Explorer or Netscape Navigator. No additional software should be required.
2. The embedded web-pages shall be secured by use of a customizable user name and password.
3. Standard Ethernet hubs, switches and routers can be used, although industrial grade devices are recommended if the environmental conditions warrant.
4. The Ethernet Communications Card shall support the following services via the standard Ethernet Port 502:
   a) TCP/Modbus Client, with support for periodic I/O Scanning
   b) HTTP Server for drive configuration, control, and monitoring.
   c) ICMP client to support certain IP services such as the “ping” command.
   d) BOOTP client to assign an IP Address via an address server.
5. The Ethernet Communications card shall have diagnostic LED that monitor communication

2.12 KEYPAD DISPLAY REQUIREMENTS

A. The keypad display shall be menu based and offer the modification of VFD adjustments via a touch keypad. All electrical values, configuration parameters, I/O assignments, application and activity function access, faults, local keypad control, and adjustment storage will be in plain English.

B. The display will be a high-resolution, backlighted LCD screen capable of displaying 4 lines of 20 alphanumeric characters.

C. The VFD model number, torque type, software revision number, horsepower, output current, motor frequency and motor voltage shall all be listed on the drive identification display as viewed on the LCD display.

D. The keypad interface shall be configured to display selectable outputs such as speed reference, output frequency, output current, motor torque, output power, output voltage, line voltage, DC voltage, motor thermal state, drive thermal state, elapsed time, motor speed, machine speed reference and machine speed.

E. The operator terminal shall provide a main menu consisting of status, programming, drive configuration, and keypad operation. A hardware jumper lock shall protect drive setup from unauthorized personnel by limiting access to the programming and drive configuration menus. A software password shall be configured to limit access to all menus except status. The status menu shall show meters, I/O map, fault history and drive identification.

F. There will be arrow keys that will provide the ability to scroll through menus and screens, select or activate functions or increase the value of a selected parameter.

G. A data entry key will allow the user to confirm a selected menu, numeric value or allow selection between multiple choices.

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:

1. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2 and 3 control cables.

1.3 DEFINITIONS

A. VFC: Variable frequency controller.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden Inc.
2. General Cable; General Cable Corporation.
3. Southwire Company.

B. [Aluminum[and Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THWN-2.

D. VFC Cable:

1. Comply with UL 1277, UL 1685, and NFPA 70 for Type TC-ER cable.
2. Type TC-ER with oversized crosslinked polyethylene insulation, spiral-wrapped foil plus 85 percent coverage braided shields and insulated full-size ground wire, and sunlight- and oil-resistant outer PVC jacket.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M.
2. Hubbell Power Systems, Inc.
3. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper for feeders smaller than No. 350 AWG and below; aluminum for feeders No. 400 AWG and larger. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THWN-2, single conductors in raceway.

B. Exposed Feeders: Type THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THWN-2, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THWN-2, single conductors in raceway.

G. Retain one shield option with Type TC-ER cable in "VFC Output Circuits" Paragraph below.

H. VFC Output Circuits: Type XHHW-2 in metal conduit .

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors and conductors feeding the following critical equipment and services for compliance with requirements.

   a. Feeders for pumps P1, P2 and P3.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

D. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

SECTION 260523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Low-voltage control cabling.
   2. Control-circuit conductors.
   3. Identification products.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

2.2 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

   1. Multi-pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
   2. PVC insulation.
   3. Unshielded.
   4. PVC jacket.
   5. Flame Resistance: Comply with UL 1685.

2.3 CONTROL-CIRCUIT CONDUCTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Encore Wire Corporation.
2. General Cable; General Cable Corporation.
3. Southwire Company.

B. Class 1 Control Circuits: Stranded copper, Type THWN-2, in raceway, complying with UL 44.

C. Class 2 Control Circuits: Stranded copper, Type THWN-2, in raceway, complying with UL 44.

2.4 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP cables according to TIA-568-C.2.

C. Factory test optical-fiber cables according to TIA-568-C.3.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

3.2 INSTALLATION OF RACEWAYS AND BOXES

A. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

B. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.

C. Install manufactured conduit sweeps and long-radius elbows if possible.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1 and NFPA 70.

B. General Requirements for Cabling:

1. Cables may not be spliced.
2. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
3. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems." Install lacing bars and distribution spools.
4. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
5. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
6. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.

C. Installation of Control-Circuit Conductors:

1. Install wiring in raceways. Comply with requirements specified in Section 260533 "Raceways and Boxes for Electrical Systems."

2. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

   a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
   b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 6 inches.
   c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 12 inches.

3. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

   a. Electrical Equipment or Circuit Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 3 inches.
   c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 6 inches.

4. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inches.
5. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.4 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits; No 14 AWG.

2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.

3.5 GROUNDING

A. For low-voltage control wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.6 IDENTIFICATION

A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Identify data and communications system components, wiring, and cabling according to TIA-606-A; label printers shall use label stocks, laminating adhesives, and inks complying with UL 969.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections:

1. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

D. End-to-end cabling will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 260523

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Burndy; Part of Hubbell Electrical Systems.
2. Harger Lightning & Grounding.
3. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet..

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.

4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.

3.5 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal[**,and at individual ground rods**. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

E. Grounding system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: **10** ohms.

H. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.

2. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Tube & Conduit.
2. Cooper B-Line, Inc.; a division of Cooper Industries.
3. Thomas & Betts Corporation.

C. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- diameter holes at a maximum of 8 inches o.c., in at least 1 surface.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. Fabco Plastics Wholesale Limited.

2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
3. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
4. Rated Strength: Selected to suit applicable load criteria.

D. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

E. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

F. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

G. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

H. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Hilti, Inc.
   b. ITW Ramset/Red Head; Illinois Tool Works, Inc.
   c. MKT Fastening, LLC.

3. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Cooper B-Line, Inc.; a division of Cooper Industries.
   b. Hilti, Inc.
   c. ITW Ramset/Red Head; Illinois Tool Works, Inc.

5. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
6. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
7. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
8. Toggle Bolts: All-steel springhead type.
9. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slottedsupport system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi20.7-MPa)] , 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
2. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.
3. Section 280528 "Pathways for Electronic Safety and Security" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving electronic safety and security.

1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Qualification Data: For professional engineer.

C. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Tube & Conduit.
2. Republic Conduit.
3. Western Tube and Conduit Corporation.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. FMC: Comply with UL 1; zinc-coated steel oraluminum.

E. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

F. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.

2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

G. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CANTEX INC.
2. Condux International, Inc.
3. Electri-Flex Company.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. ENT: Comply with NEMA TC 13 and UL 1653.

D. RNC: Type EPC-40-PVC < >, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

E. LFNC: Comply with UL 1660.

F. Rigid HDPE: Comply with UL 651A.

G. Continuous HDPE: Comply with UL 651B.

H. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.

I. RTRC: Comply with UL 1684A and NEMA TC 14.

J. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

K. Fittings for LFNC: Comply with UL 514B.

L. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

M. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Hoffman; a brand of Pentair Equipment Protection.
3. MonoSystems, Inc.
4. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 Type 3R [< > unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type [] unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Technologies Company.
2. Hubbell Incorporated.
3. Milbank Manufacturing Co.
4. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
5. RACO; Hubbell.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloyor aluminum, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminumorgalvanized, cast iron with gasketed cover.

I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

J. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep) [mm >.

K. Gangable boxes are allowed [are prohibited].

L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1or Type 3R > with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

M. Cabinets:

1. NEMA 250, Type 1 or Type 3R [> galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Oldcastle Precast, Inc.
   b. Quazite: Hubbell Power Systems, Inc.

2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with open][] bottom unless otherwise indicated.

4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, ["ELECTRIC."] <Insert legend>.
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long) < > and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of polymer concrete []] [].

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Nordic Fiberglass, Inc.
   b. Quazite: Hubbell Power Systems, Inc.

2. Standard: Comply with SCTE 77.
3. Color of Frame and Cover: Gray [
4. Configuration: Designed for flush burial with open [] bottom unless otherwise indicated.
5. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
6. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
7. Cover Legend: Molded lettering, "ELECTRIC." < >.
8. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
9. Handholes [12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long)] < and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.6 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC [-].
2. Concealed Conduit, Aboveground: GRC [Underground Conduit: RNC, Type EPC-40-PVC [direct buried and concrete encased where indicated.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC [].
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 4.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: [RNC.
2. Exposed and Subject to Severe Physical Damage: GRC]Raceway locations include the following:

a. Loading dock.
b. Pump Rooms and equipment room.

3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
4. Damp or Wet Locations: GRC .
5. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel, wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C) <

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches (300 mm)of enclosures to which attached.

I. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m)intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 1 inch (25 mm) [< d> of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

J. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

Q. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

S. Surface Raceways:

1. Install surface raceway with a minimum 2-inch (50-mm)radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

T. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

U. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

V. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

W. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC[ ] conduit that is located where

environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).

2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C)]< > temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) <In e> temperature change.
   c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) < > temperature change.
   d. >.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

X. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for [equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

   1. Use LFMC in damp or wet locations subject to severe physical damage.
   2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

Y. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center][of box unless otherwise indicated.

Z. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

BB. Locate boxes so that cover or plate will not span different building finishes.

CC. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

DD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

EE. Set metal floor boxes level and flush with finished floor surface.

FF. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits but a minimum of 6 inches (150 mm) below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Install handholes with bottom below frost line, <24 Inches > below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Direct-buried conduit, ducts, and duct accessories.
2. Concrete-encased conduit, ducts, and duct accessories.
3. Handholes and boxes.
4. Manholes.

1.3 DEFINITIONS

A. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include duct-bank materials, including separators and miscellaneous components.
2. Include ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Include accessories for manholes, handholes, boxes].
4. Include warning tape.
5. Include warning planks.

B. Shop Drawings:

1. Precast or Factory-Fabricated Underground Utility Structures:

a. Include plans, elevations, sections, details, attachments to other work, and accessories.
b. Include duct entry provisions, including locations and duct sizes.
c. Include reinforcement details.
d. Include frame and cover design and manhole frame support rings.
e. Include grounding details.
f. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
g. Include joint details.

2. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:

   a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
   b. Include duct entry provisions, including locations and duct sizes.
   c. Include cover design.
   d. Include grounding details.
   e. Include dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.5 INFORMATIONAL SUBMITTALS

A. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.

   1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
   2. Drawings shall be signed and sealed by a qualified professional engineer.

B. Product Certificates: For concrete and steel used in precast concrete manholes]and handholes, as required by ASTM C 858.

C. Qualification Data: For professional engineer and testing agency responsible for testing nonconcrete handholes and boxes.

D. Source quality-control reports.

E. Field quality-control reports.

1.6 MAINTENANCE MATERIALS SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

1.8 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:

   1. Notify [Owner no fewer than [Seven > days in advance of proposed interruption of electrical service.
   2. Do not proceed with interruption of electrical service without] [[Owner's written permission.

B. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.

C. Ground Water: Assume ground-water level is 36 inches (900 mm) < > below ground surface unless a higher water table is noted on Drawings.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR DUCTS AND RACEWAYS

A. Comply with ANSI C2.

2.2 CONDUIT

A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

B. RNC: NEMA TC 2, Type EPC-40-PVC [UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.3 NONMETALLIC DUCTS AND DUCT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, [] provide products by one of the following []:

1. ARNCO Corp.
2. Beck Manufacturing.
3. Cantex, Inc.
4. CertainTeed Corporation.
5. Condux International, Inc.
6. ElecSys, Inc.
7. Electri-Flex Company.
8. IPEX Inc.
9. Lamson & Sessions; Carlon Electrical Products.
10. Spiraduct/AFC Cable Systems, Inc.

B. Underground Plastic Utilities Duct: NEMA TC 2, UL 651, ASTM F 512, [[] Type EPC-40, with matching fittings complying with NEMA TC 3 by same manufacturer as the duct.

C. Underground Plastic Utilities Duct: NEMA TC 6 & 8, ASTM F 512, Type DB-60-PVC], for direct burial, with matching fittings complying with NEMA TC 9 by same manufacturer as the duct.

D. Duct Accessories:

1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and size of ducts with which used, and selected to provide minimum duct spacing indicated while supporting ducts during concreting or backfilling.

2. Warning Tape: Underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."
3. Concrete Warning Planks: Nominal 12 by 24 by 3 inches (300 by 600 by 75 mm) in size, manufactured from 6000-psi (41-MPa) concrete.

    a. Color: Red dye added to concrete during batching.
    b. Mark each plank with "ELECTRIC" in 2-inch- (50-mm-) high, 3/8-inch- (10-mm-) deep letters.

2.4 PRECAST CONCRETE HANDHOLES AND BOXES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Americast Concrete Products, Inc.
2. Hanson Concrete Products, Inc.
3. Oldcastle Precast Group.
4. Rinker Group, Ltd.

B. Comply with ASTM C 858 for design and manufacturing processes.

C. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.

1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
2. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
3. Frame and Cover: Weatherproof steel frame, with hinged steel access door assembly with tamper-resistant, captive, cover-securing bolts.

    a. Cover Hinges: Concealed, with hold-open ratchet assembly.
    b. Cover Handle: Recessed.

4. Frame and Cover: Weatherproof aluminum frame with hinged aluminum access door assembly with tamper-resistant, captive, cover-securing bolts.

    a. Cover Hinges: Concealed, with hold-open ratchet assembly.
    b. Cover Handle: Recessed.

5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC."[<.>
7. Configuration: Units shall be designed for flush burial and have open [c] [] bottom unless otherwise indicated.
8. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.

    a. Extension shall provide increased depth of 12 inches (300 mm) <
    b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.

9. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.
10. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks, plus an additional 12 inches (300 mm) vertically and horizontally to accommodate alignment variations.

    a. Windows shall be located no less than 6 inches (150 mm) from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
    b. Window opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
    c. Window openings shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.

11. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

    a. Type and size shall match fittings to duct or conduit to be terminated.
    b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.

12. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.5 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. General Requirements for Handholes and Boxes: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.

1. Color: Gray
2. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC."
6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
7. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) < > and larger shall have factory-installed inserts for cable racks and pulling-in irons.

B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
   a. Armorcast Products Company.
   b. Carson Industries LLC.
   c. NewBasis.
   d. Quazite: Hubbell Power System, Inc.

2.6 PRECAST MANHOLES

A. Manufacturers: Subject to compliance with requirements, [provide products by the following] provide products by one of the following []:
   1. Americast Concrete Products, Inc.
   2. Hanson Concrete Products, Inc.
   3. Oldcastle Precast Group.
   4. Rinker Group, Ltd.

B. Comply with ASTM C 858.

C. Structural Design Loading: Comply with requirements in "Underground Enclosure Application" Article.

D. Precast Manholes: One-piece units and units with interlocking mating sections, complete with accessories, hardware, and features.

E. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks, plus an additional 12 inches (300 mm) vertically and horizontally to accommodate alignment variations.

   1. Windows shall be located no less than 6 inches (150 mm) from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.
   2. Window opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
   3. Window openings shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.

F. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

   1. Type and size shall match fittings to duct or conduit to be terminated.
   2. Fittings shall align with elevations of approaching ducts and be located near interior corners of manholes to facilitate racking of cable.

G. Concrete Knockout Panels: 1-1/2 to 2 inches (38 to 50 mm) thick, for future conduit entrance and sleeve for ground rod.

H. Ground Rod Sleeve: Provide a 3-inch (75-mm) PVC conduit sleeve in manhole floors 2 inches (50 mm) from the wall adjacent to, but not underneath, the ducts routed from the facility.

I. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

2.7 UTILITY STRUCTURE ACCESSORIES

A. Manufacturers: Subject to compliance with requirements provide products by one of the following []:

1. Bilco Company (The).
2. Campbell Foundry Company.
3. Christy Concrete Products.
4. East Jordan Iron Works, Inc.
5. Elmhurst-Chicago Stone Co.
6. McKinley Iron Works, Inc.
7. Neenah Foundry Company.
8. NewBasis.
9. Oldcastle Precast Group.
10. Osburn Associates, Inc.
11. Pennsylvania Insert Corporation.
12. Quazite:Hubbell Power Systems, Inc.
13. Rinker Group, Ltd.
14. Riverton Concrete Products.
15. Underground Devices, Inc.
16. Utility Concrete Products, LLC.
17. Utility Vault Co.
18. Wausau Tile Inc.

19. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A 48/A 48M, Class 30B [with milled cover-to-frame bearing surfaces; diameter, 26 inches (660 mm) [

    a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
    b. Special Covers: Recess in face of cover designed to accept finish material in paved areas.

20. Cover Legend: Cast in. Selected to suit system.

    a. Legend: "ELECTRIC-LV" for duct systems with power wires and cables for systems operating at 600 V and less.
    b. Legend: "ELECTRIC-HV" for duct systems with medium-voltage cables.

21. Manhole Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.

    a. Mortar for Chimney Ring and Frame and Cover Joints: Comply with ASTM C 270, Type M, except for quantities less than 2.0 cu. ft. (60 L) where packaged mix complying with ASTM C 387, Type M, may be used.

b. Seal joints watertight using preformed plastic or rubber conforming to ASTM C 990. Install sealing material according to the sealant manufacturers' printed instructions.

B. Manhole Sump Frame and Grate: ASTM A 48/A 48M, Class 30B, gray cast iron.

C. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch- (50-mm-) diameter eye, and 1-by-4-inch (25-by-100-mm) bolt.

1. Working Load Embedded in 6-Inch (150-mm), 4000-psi (27.6-MPa) Concrete: 13,000-lbf (58-kN) minimum tension.

D. Pulling Eyes in Nonconcrete Walls: Eyebolt with reinforced fastening, 1-1/4-inch- (31-mm-) diameter eye, rated 2500-lbf (11-kN) < minimum tension.

E. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch- (22-mm-) diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.

1. Ultimate Yield Strength: 40,000-lbf (180-kN) shear and 60,000-lbf (270-kN) tension.

F. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch (13-mm) ID by 2-3/4 inches (69 mm) deep, flared to 1-1/4 inches (31 mm) minimum at base.

1. Tested Ultimate Pullout Strength: 12,000 lbf (53 kN) minimum.

G. Ground Rod Sleeve: 3-inch (75-mm), PVC conduit sleeve in manhole floors 2 inches (50 mm) from the wall adjacent to, but not underneath, the ducts routed from the facility.

H. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch (13-mm) bolt, 5300-lbf (24-kN) rated pullout strength, and minimum 6800-lbf (30-kN) rated shear strength.

I. Cable Rack Assembly: Steel, hot-rolled [] galvanized, except insulators.

1. Stanchions: T-section or channel; 2-1/4-inch (56-mm) nominal size; punched with 14 holes on 1-1/2-inch (38-mm) centers for cable-arm attachment.
2. Arms: 1-1/2 inches (38 mm) wide, lengths ranging from 3 inches (75 mm) with 450-lb (204-kg) minimum capacity to 18 inches (450 mm) with 250-lb (114-kg) minimum capacity. Arms shall have slots along full length for cable ties and be arranged for secure mounting in horizontal position at any vertical location on stanchions.
3. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.

J. Cable Rack Assembly: Nonmetallic. Components fabricated from nonconductive, fiberglass-reinforced polymer.

1. Stanchions: Nominal 36 inches (900 mm) high by 4 inches (100 mm) wide, with minimum of nine holes for arm attachment.

2. Arms: Arranged for secure, drop-in attachment in horizontal position at any location on cable stanchions, and capable of being locked in position. Arms shall be available in lengths ranging from 3 inches (75 mm) with 450-lb (204-kg) minimum capacity to 20 inches (500 mm) with 250-lb (114-kg) minimum capacity. Top of arm shall be nominally 4 inches (100 mm) wide, and arm shall have slots along full length for cable ties.

K. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F (2 deg C). Capable of withstanding temperature of 300 deg F (150 deg C) without slump and adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

2.8 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.

C. Clear and grub vegetation to be removed, and protect vegetation to remain.

3.2 UNDERGROUND DUCT APPLICATION

A. Ducts for Electrical Cables More than 600 V: RNC, NEMA [Type EPC-40][PVC, in concrete-encased duct bank unless otherwise indicated.

B. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA [Type EPC-40 [PVC, in concrete-encased duct bank unless otherwise indicated.

C. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA [] Type EPC-40-PVC, in direct-buried duct bank unless otherwise indicated.

D. Ducts for Electrical Branch Circuits: RNC, NEMA [Type EPC-40-PVC, in direct-buried duct bank unless otherwise indicated.

3.3 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes and Boxes for 600 V and Less:

1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-10 [structural load rating.
2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 Polymer concrete, SCTE 77, Tier 15 [] [:
3. .
4. Cover design load shall not exceed the design load of the handhole or box.

B. Manholes: [Precast [concrete.

1. Units Located in Roadways and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating according to AASHTO HB 17.
2. Units Not Located in Deliberate Traffic Paths by Heavy or Medium Vehicles: H-10 load rating according to AASHTO HB 17.

3.4 EARTHWORK

A. Excavation and Backfill: Comply with Section 312000 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Cut and patch existing pavement in the path of underground ducts and utility structures.

3.5 DUCT INSTALLATION

A. Install ducts according to NEMA TCB 2.

B. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes, to drain in both directions.

C. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches (1200 mm) [(both horizontally and vertically, at other locations unless otherwise indicated.

D. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

E. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches (250 mm) o.c. for 5-inch (125-mm) ducts, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to end-bell spacing 10 feet (3 m) from the end bell without reducing duct line slope and without forming a trap in the line.
2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line direct-buried duct banks with calculated expansion of more than 3/4 inch (19 mm).
3. Grout end bells into structure walls from both sides to provide watertight entrances.

F. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet (3 m) outside the building wall, without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

G. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.

H. Pulling Cord: Install 100-lbf- (445-N-) test nylon cord in empty ducts.

I. Concrete-Encased Ducts: Support ducts on duct separators.

1. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Section 312000 "Earth Moving" for pipes less than 6 inches (150 mm) in nominal diameter.
2. Width: Excavate trench 12 inches (300 mm) wider than duct bank on each side.
3. Width: Excavate trench 3 inches (75 mm) wider than duct bank on each side.
4. Depth: Install top of duct bank at least 24 inches (600 mm) below finished grade in areas not subject to deliberate traffic, and at least 30 inches (750 mm) below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
5. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
6. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than [four] [five] spacers per 20 feet (6 m) of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators

approximately 6 inches (150 mm) between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

7. Minimum Space between Ducts: 3 inches (75 mm) between ducts and exterior envelope wall, 2 inches (50 mm) between ducts for like services, and 4 inches (100 mm) between power and signal ducts.
8. Elbows: Use manufactured duct elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run unless otherwise indicated. Extend concrete encasement throughout length of elbow.
9. Elbows: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
    b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of base. Install insulated grounding bushings on terminations at equipment.

10. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
11. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
12. Concrete Cover: Install a minimum of 3 inches (75 mm) of concrete cover at top and bottom, and a minimum of 2 inches (50 mm) on each side of duct bank.
13. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.

    a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
    b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch (15-mm) reinforcing-rod dowels extending a minimum of 18 inches (450 mm) into concrete on both sides of joint near corners of envelope.

14. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 033000 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

J. Direct-Buried Duct Banks:

1. Excavate trench bottom to provide firm and uniform support for duct bank. Comply with requirements in Section 312000 "Earth Moving" for preparation of trench bottoms for pipes less than 6 inches (150 mm) in nominal diameter.
2. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.

3. Space separators close enough to prevent sagging and deforming of ducts, with not less than four [f] spacers per 20 feet (6 m) of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches (150 mm) between tiers.
4. Depth: Install top of duct bank at least 36 inches (900 mm) below finished grade unless otherwise indicated.
5. Set elevation of bottom of duct bank below frost line.
6. Install ducts with a minimum of 3 inches (75 mm) between ducts for like services and 6 inches (150 mm) between power and signal ducts.
7. Elbows: Install manufactured duct elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
8. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
    b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

9. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches (100 mm) over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 312000 "Earth Moving" for installation of backfill materials.

    a. Place minimum 3 inches (75 mm) of sand as a bed for duct bank. Place sand to a minimum of 6 inches (150 mm) above top level of duct bank.
    b. Place minimum 6 inches (150 mm) of engineered fill above concrete encasement of duct bank.

K. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried ducts and duct banks, placing them 24 inches (600 mm) o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional planks 12 inches (300 mm) apart, horizontally.

L. Warning Tape: Bury warning tape approximately 12 inches (300 mm) above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches (75 mm) of centerline of duct bank. Provide an additional warning tape for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional tapes 12 inches (300 mm) apart, horizontally.

3.6 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Cast-in-Place Manhole Installation:

1. Finish interior surfaces with a smooth-troweled finish.
2. Windows for Future Duct Connections: Form and pour concrete knockout panels 1-1/2 to 2 inches (38 to 50 mm) thick, arranged as indicated.
3. Comply with requirements in Section 033000 "Cast-in-Place Concrete" for cast-in-place concrete, formwork, and reinforcement.

B. Precast Concrete Handhole and Manhole Installation:

1. Comply with ASTM C 891 unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch (25-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevations:

1. Manhole Roof: Install with rooftop at least 15 inches (375 mm) below finished grade.
2. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch (25 mm) above finished grade.
3. Install handholes with bottom below frost line, <Insert depth of frost line below grade at Project site> below grade.
4. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
5. Where indicated, cast handhole cover frame integrally with handhole structure.

D. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.

E. Manhole Access: Circular opening in manhole roof; sized to match cover size.

1. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
2. Install chimney, constructed of precast concrete collars and rings, to support cast-iron frame to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for frame to chimney.

F. Waterproofing: Apply waterproofing to exterior surfaces of manholes[and handholes] after concrete has cured at least three days. Waterproofing materials and installation are specified in [Section 071353 "Elastomeric Sheet Waterproofing."] [Section 071354 "Thermoplastic Sheet Waterproofing."] <Insert waterproofing Section.> After ducts have been connected and grouted, and before backfilling, waterproof joints and connections, and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.

G. Dampproofing: Apply dampproofing to exterior surfaces of manholes[and handholes] after concrete has cured at least three days. Dampproofing materials and installation are specified in Section 071113 "Bituminous Dampproofing." After ducts are connected and grouted, and before

backfilling, dampproof joints and connections, and touch up abrasions and scars. Dampproof exterior of manhole chimneys after mortar has cured at least three days.

H. Hardware: Install removable hardware, including pulling eyes, cable stanchions, [and]cable arms, [and insulators,]as required for installation and support of cables and conductors and as indicated.

I. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.

J. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches (97 mm) for manholes and 2 inches (50 mm) for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

3.7 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by manufacturer.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.

D. Install handholes and boxes with bottom below frost line, <30 Inches > below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.

F. Field cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

G. For enclosures installed in [] [<graveled surfaces> and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth]< >.

1. Concrete: 3000 psi (20 kPa), 28-day strength, complying with Section 033000 "Cast-in-Place Concrete," with a troweled finish.
2. Dimensions: 10 inches wide by 12 inches deep (250 mm wide by 300 mm deep)< >.

3.8 GROUNDING

A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 6-inch- (150-mm-) long mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
3. Test manhole[and handhole] grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.10 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 260543

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING."

D. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

E. Tape and Stencil for Raceways Carrying Circuits More Than 600 V: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers diagonally over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stop stripes at legends.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.

B. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

C. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil- (0.08-mm-) thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-

resistant, self-laminating, protective shield over the legend. Labels sized to fit the cable diameter such that the clear shield overlaps the entire printed legend.

2.3 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical []utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE, i>.

2.4 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches (250 by 360 mm).

C. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
   Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.5 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.7 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black except where used for color-coding.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.

G. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in

contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

I. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

J. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench [exceeds 16 inches (400 mm) overall.

K. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high black letters on 20-inch (500-mm) centers. Stop stripes at legends. Apply to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches (300 mm) of a floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to raceways concealed within wall.
3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

B. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Self-adhesive vinyl labels. Install labels at 10-foot (3-m).

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.

a. Color shall be factory applied[or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.

3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

D. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use [nonmetallic plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation.

E. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use [self-adhesive, self-laminating polyester labels]with the conductor or cable designation, origin, and destination.

G. Control-Circuit Conductor Termination Identification: For identification at terminations provide self-adhesive, self-laminating polyester labels [with the conductor designation.

H. Conductors to Be Extended in the Future: Attach [marker tape]to conductors and list source.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

J. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

K. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.
b. Controls with external control power connections.

M. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

N. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.

O. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: [Adhesive film label with clear protective overlay[l] [Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
c. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be] engraved] laminated acrylic or melamine label.
b. Enclosures and electrical cabinets.
c. Access doors and panels for concealed electrical items.
d. Switchgear.
e. Switchboards.
f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
g. Substations.

h. Emergency system boxes and enclosures.
i. Motor-control centers.
j. Enclosed switches.
k. Enclosed circuit breakers.
l. Enclosed controllers.
m. Variable-speed controllers.
n. Push-button stations.
o. Power transfer equipment.
p. Contactors.
q. Remote-controlled switches, dimmer modules, and control devices.
r. .Power-generating units.
s. Monitoring and control equipment.

END OF SECTION 260553

SECTION 260573 - OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.

1. Study results shall be used to determine coordination of series-rated devices.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.4 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.

1. Coordination-study input data, including completed computer program input data sheets.
2. Study and equipment evaluation reports.
3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.

a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Coordination Study Software Developer Coordination Study Specialist Field Adjusting Agency.

B. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For the overcurrent protective devices to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. The following parts from the Protective Device Coordination Study Report:

1) One-line diagram.
2) Protective device coordination study.
3) Time-current coordination curves.

b. Power system data.

1.7 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Coordination Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Coordination Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. SKM Systems Analysis, Inc.

B. Comply with IEEE 242 and IEEE 399.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Optional Features:

a. Arcing faults.
b. Simultaneous faults.
c. Explicit negative sequence.
d. Mutual coupling in zero sequence.

2.2 PROTECTIVE DEVICE COORDINATION STUDY REPORT CONTENTS

A. Executive summary.

B. Study descriptions, purpose, basis and scope. Include case descriptions, definition of terms and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study:

1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

   a. Voltage.
   b. Calculated fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. Equivalent impedance.

2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. Calculated asymmetrical fault currents:

      1) Based on fault-point X/R ratio.
      2) Based on calculated symmetrical value multiplied by 1.6.
      3) Based on calculated symmetrical value multiplied by 2.7.

3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. No AC Decrement (NACD) ratio.
   e. Equivalent impedance.
   f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
   g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

F. Protective Device Coordination Study:

1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.

   a. Phase and Ground Relays:

      1) Device tag.
      2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
      3) Recommendations on improved relaying systems, if applicable.

   b. Circuit Breakers:

      1) Adjustable pickups and time delays (long time, short time, ground).
      2) Adjustable time-current characteristic.

3) Adjustable instantaneous pickup.
4) Recommendations on improved trip systems, if applicable.

c. Fuses: Show current rating, voltage, and class.

G. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4. Plot the following listed characteristic curves, as applicable:

a. Power utility's overcurrent protective device.
b. Medium-voltage equipment overcurrent relays.
c. Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
f. Cables and conductors damage curves.
g. Ground-fault protective devices.
h. Motor-starting characteristics and motor damage points.
i. Generator short-circuit decrement curve and generator damage point.
j. The largest feeder circuit breaker in each motor-control center and panelboard.

5. Series rating on equipment allows the application of two series interrupting devices for a condition where the available fault current is greater than the interrupting rating of the downstream equipment. Both devices share in the interruption of the fault and selectivity is sacrificed at high fault levels. Maintain selectivity for tripping currents caused by overloads.
6. Provide adequate time margins between device characteristics such that selective operation is achieved.
7. Comments and recommendations for system improvements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 PROTECTIVE DEVICE COORDINATION STUDY

A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.

B. Comply with IEEE 399 for general study procedures.

C. The study shall be based on the device characteristics supplied by device manufacturer.

D. Begin analysis at the service, extending down to the system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.

E. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

F. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:

a. Inrush current when first energized.
b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

G. Motor Protection:

1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
2. Select protection for motors served at voltages more than 600 V according to IEEE 620.

H. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

I. Generator Protection: Select protection according to manufacturer's written recommendations and to IEEE 242.

J. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

K. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and single line-to-ground fault at each of the following:

1. Electric utility's supply termination point.
2. Switchgear.
3. Unit substation primary and secondary terminals.
4. Low-voltage switchgear.
5. Motor-control centers.
6. Standby generators and automatic transfer switches.
7. Branch circuit panelboards.

L. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.
3. Any application of series-rated devices shall be recertified, complying with requirements in NFPA 70.

3.3 LOAD-FLOW AND VOLTAGE-DROP STUDY

A. Perform a load-flow and voltage-drop study to determine the steady-state loading profile of the system. Analyze power system performance two times as follows:

1. Determine load-flow and voltage drop based on full-load currents obtained in "Power System Data" Article.
2. Determine load-flow and voltage drop based on 80 percent of the design capacity of the load buses.
3. Prepare the load-flow and voltage-drop analysis and report to show power system components that are overloaded, or might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.

3.4 MOTOR-STARTING STUDY

A. Perform a motor-starting study to analyze the transient effect of the system's voltage profile during motor starting. Calculate significant motor-starting voltage profiles and analyze the effects of the motor starting on the power system stability.

B. Prepare the motor-starting study report, noting light flicker for limits proposed by IEEE 141, and Insert applicable standards, and voltage sags so as not to affect the operation of other utilization equipment on the system supplying the motor.

3.5 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the overcurrent protective device study.

1. Verify completeness of data supplied in the one-line diagram on Drawings. Call discrepancies to the attention of Architect.
2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
3. For existing equipment, whether or not relocated obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. The qualifications of technicians and engineers shall be qualified as defined by NFPA 70E.

B. Gather and tabulate the following input data to support coordination study. The list below is a guide. Comply with recommendations in IEEE 241 and IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Electrical power utility impedance at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus, three phase and line-to-ground.
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Maximum demands from service meters.
13. Motor horsepower and NEMA MG 1 code letter designation.
14. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
15. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.
16. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:

    a. Special load considerations, including starting inrush currents and frequent starting and stopping.

b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
d. Generator thermal-damage curve.
e. Ratings, types, and settings of utility company's overcurrent protective devices.
f. Special overcurrent protective device settings or types stipulated by utility company.
g. Time-current-characteristic curves of devices indicated to be coordinated.
h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
j. Panelboards, switchboards, motor-control center ampacity, and SCCR in amperes rms symmetrical.
k. Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of the downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

3.6 FIELD ADJUSTING

A. Adjust relay and protective device settings according to the recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.

C. Testing and adjusting shall be by a full-time employee of the Field Adjusting Agency, who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

END OF SECTION 260573

SECTION 260574 - OVERCURRENT PROTECTIVE DEVICE ARC-FLASH STUDY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.4 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals [may be in digital form.

1. Arc-flash study input data, including completed computer program input data sheets.
2. Arc-flash study report; signed, dated, and sealed by a qualified professional engineer.

    a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary

submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Arc-Flash Study Software Developer Arc-Flash Study Specialist]Field Adjusting Agency.

B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance procedures according to requirements in NFPA 70E shall be provided in the equipment manuals.

B. Operation and Maintenance Procedures: In addition to items specified in Section 017823 "Operation and Maintenance Data," provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

1.7 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Arc-Flash Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Arc-Flash Study Specialist Qualifications: Professional engineer in charge of performing the study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. SKM Systems Analysis, Inc.

B. Comply with IEEE 1584 and NFPA 70E.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

2.2 SHORT-CIRCUIT STUDY REPORT CONTENT

A. Executive summary.

B. Study descriptions, purpose, basis and scope.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center and panelboard designations.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output:

1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. No AC Decrement (NACD) ratio.
e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

F. Incident Energy and Flash Protection Boundary Calculations:

1. Arcing fault magnitude.
2. Protective device clearing time.
3. Duration of arc.
4. Arc-flash boundary.

5. Working distance.
6. Incident energy.
7. Hazard risk category.
8. Recommendations for arc-flash energy reduction.

G. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of the computer printout.

2.3 ARC-FLASH WARNING LABELS

A. Comply with requirements in Section 260553 "Identification for Electrical Systems." Produce a 3.5-by-5-inch (76-by-127-mm) thermal transfer label of high-adhesion polyester for each work location included in the analysis.

B. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

1. Location designation.
2. Nominal voltage.
3. Flash protection boundary.
4. Hazard risk category.
5. Incident energy.
6. Working distance.
7. Engineering report number, revision number, and issue date.

C. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 SHORT-CIRCUIT STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Calculate short-circuit currents according to IEEE 551.

C. Base study on the device characteristics supplied by device manufacturer.

D. The extent of the electrical power system to be studied is indicated on Drawings.

E. Begin analysis at the service, extending down to the system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems.

H. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and single line-to-ground fault at each of the following:

1. Electric utility's supply termination point.
2. .
3. .
4. Low-voltage switchgear.
5. Motor-control centers.
6. Standby generators and automatic transfer switches.
7. Branch circuit panelboards.

3.3 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Use the short-circuit study output and the field-verified settings of the overcurrent devices.

C. Calculate maximum and minimum contributions of fault-current size.

1. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume no motor load.
2. The maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

D. Calculate the arc-flash protection boundary and incident energy at locations in the electrical distribution system where personnel could perform work on energized parts.

E. Include medium- and low-voltage equipment locations, except 240-V ac and 208-V ac systems fed from transformers less than 125 kVA.

F. Safe working distances shall be specified for calculated fault locations based on the calculated arc-flash boundary, considering incident energy of 1.2 cal/sq.cm.

G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond three to five cycles.
2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g., contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).

H. Arc-flash computation shall include both line and load side of a circuit breaker as follows:

1. When the circuit breaker is in a separate enclosure.
2. When the line terminals of the circuit breaker are separate from the work location.

I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.4 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the arc-flash hazard analysis.

1. Verify completeness of data supplied on the one-line diagram on Drawings. Call discrepancies to the attention of Architect.
2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers.

B. Gather and tabulate the following input data to support coordination study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at the service.
3. Power sources and ties.
4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in per cent, and phase shift.
5. For reactors, provide manufacturer and model designation, voltage rating and impedance.
6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
8. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
9. .

10. Motor horsepower and NEMA MG 1 code letter designation.
11. Low-voltage cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
12. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.

3.5 LABELING

A. Apply one arc-flash label for 600-V ac, 480-V ac, and applicable 208-V ac panelboards and disconnects and for each of the following locations:

1. Motor-control center.
2. Low-voltage switchboard.
3. Switchgear.
4. Medium-voltage switch.
5. Control panel.

3.6 APPLICATION OF WARNING LABELS

A. Install the arc-fault warning labels under the direct supervision and control of the Arc-Flash Study Specialist.

3.7 DEMONSTRATION

A. Engage the Arc-Flash Study Specialist to train Owner's maintenance personnel in the potential arc-flash hazards associated with working on energized equipment and the significance of the arc-flash warning labels.

END OF SECTION 260574

SECTION 262200 - LOW-VOLTAGE TRANSFORMERS

1.1 SUMMARY

A. Section Includes: Distribution, dry-type transformers rated 600 V and less, with capacities up to 1500 kVA.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.

B. Shop Drawings:

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
3. Include diagrams for power, signal, and control wiring.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company.
3. Square D; by Schneider Electric.

B. Source Limitations: Obtain each transformer type from single source from single manufacturer.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Transformers Rated 15 kVA and Larger: Comply with NEMA TP 1 energy-efficiency levels as verified by testing according to NEMA TP 2.

D. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.

E. Coils: Continuous windings without splices except for taps.

1. Internal Coil Connections: Brazed or pressure type.
2. Coil Material: Aluminum.

F. Shipping Restraints: Paint or otherwise color code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NFPA 70, and list and label as complying with UL 1561.

B. Cores: One leg per phase.

C. Enclosure: Ventilated.

1. NEMA 250, Type 2

2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.

D. Transformer Enclosure Finish: Comply with NEMA 250.

1. Finish Color: Gray.

E. Taps for Transformers 3 kVA and Smaller: None.

F. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.

G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

H. Insulation Class, Smaller than 30 kVA: 185 deg C, UL-component-recognized insulation system with a maximum of 115-deg C rise above 40-deg C ambient temperature.

I. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 150-deg C rise above 40-deg C ambient temperature.

J. Fungus Proofing: Permanent fungicidal treatment for coil and core.

K. Low-Sound-Level Requirements: Maximum sound levels when factory tested according to IEEE C57.12.91, as follows:

1. 9 kVA and Less.
2. 30 to 50 kVA.

3. 51 to 150 kVA.

2.4 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.01 and IEEE C57.12.91.

1. Resistance measurements of all windings at the rated voltage connections and at all tap connections.
2. Ratio tests at the rated voltage connections and at all tap connections.
3. Phase relation and polarity tests at the rated voltage connections.
4. No load losses, and excitation current and rated voltage at the rated voltage connections.
5. Impedance and load losses at rated current and rated frequency at the rated voltage connections.
6. Applied and induced tensile tests.
7. Regulation and efficiency at rated load and voltage.
8. Insulation Resistance Tests:

    a. High-voltage to ground.
    b. Low-voltage to ground.
    c. High-voltage to low-voltage.

9. Temperature tests.

END OF SECTION 262200

SECTION 262413 - SWITCHBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Service and distribution switchboards rated 600 V and less.
2. Surge protection devices.
3. Disconnecting and overcurrent protective devices.
4. Control power.
5. Accessory components and features.

1.2 ACTION SUBMITTALS

A. Product Data: For each switchboard, overcurrent protective device, surge protection device, ground-fault protector, accessory, and component.

1. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
6. Detail utility company's metering provisions with indication of approval by utility company.
7. Include evidence of NRTL listing for series rating of installed devices.
8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
9. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
10. Include diagram and details of proposed mimic bus.
11. Include schematic and wiring diagrams for power, signal, and control wiring.

1.3 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace switchboard enclosures, buswork, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Delivery.

B. Manufacturer's Warranty: Manufacturer's agrees to repair or replace surge protection devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Delivery.

PART 2 - PRODUCTS

2.1 SWITCHBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company.
3. Square D; by Schneider Electric.

B. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 2.

F. Comply with NFPA 70.

G. Comply with UL 891.

H. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Panel mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

I. Nominal System Voltage: 480Y/277 V.

J. Main-Bus Continuous: 2000 A.

K. Indoor Enclosures: Steel, NEMA 250, Type 2.

L. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

M. Barriers: Between adjacent switchboard sections.

N. Insulation and isolation for main bus of main section and main and vertical buses of feeder sections.

O. Service Entrance Rating: Switchboards intended for use as service entrance equipment shall contain from one to six service disconnecting means with overcurrent protection, a neutral bus with disconnecting link, a grounding electrode conductor terminal, and a main bonding jumper.

P. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

Q. Hinged Front Panels: Allow access to circuit breaker.

R. Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Provide phase bus arrangement A, B, C from front to back, top to bottom, and left to right when viewed from the front of the switchboard.
2. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity.
3. Copper feeder circuit-breaker line connections.
4. Ground Bus: 1/4-by-2-inch- hard-drawn copper of 98 percent conductivity, equipped with compression connectors for feeder and branch-circuit ground conductors.
5. Main-Phase Buses and Equipment-Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections
6. Disconnect Links:
   a. Bond neutral bus to equipment-ground bus for switchboards utilized as service equipment or separately derived systems.
7. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.

S. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components including instruments and instrument transformers.

2.2 SURGE PROTECTION DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company.
3. Square D; by Schneider Electric.

B. SPDs: Comply with UL 1449, Type 1.

C. SPDs with the following features and accessories:

a. Integral disconnect switch.

b. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
c. Indicator light display for protection status.
d. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status.
e. Surge counter.

D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 250kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

E. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 1200 V for 480Y/277 V.
2. Line to Ground: 1200 V for 480Y/277 V.
3. Line to Line: 2000 V for 480Y/277 V.

F. SCCR: Equal or exceed 100 kA.

G. Nominal Rating: 20 kA.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long and short time adjustments.
   d. Ground-fault pickup level, time delay, and I^2t response.
4. MCCB Features and Accessories:

   a. Standard frame sizes, trip ratings, and number of poles.
   b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor material.

2.4 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

C. Mounting Accessories: For anchors, mounting channels, bolts, washers, and other mounting accessories, comply with requirements in Section 260548.16 "Seismic Controls for Electrical Systems" or manufacturer's instructions.

END OF SECTION 262413

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. SPD: Surge Protection Device.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: spares for each panelboard as indicated in the panel schedules.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."

B. Enclosures: Surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
5. Finishes:

a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Galvanized steel.
c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

6. Directory Card: Inside panelboard door, mounted in transparent card holder.

C. Incoming Mains Location: Top.

D. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Compression type.
3. Ground Lugs and Bus-Configured Terminators: Compression type.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 PERFORMANCE REQUIREMENTS

A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 2, rated for 480VL-L, >150kA peak surge current, 20kA nominal, 100kA SSC.

2.3 DISTRIBUTION PANELBOARDS

A. Distribution panelboards, as specified in this article, fall under requirements of "Power Panelboards" in NFPA 70.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company.
3. Square D.

C. Panelboards: NEMA PB 1, power and feeder distribution type.

D. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

E. Mains: MLO.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in circuit breakers.

G. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company.
3. Square D.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker.

D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company.
3. Square D.

a. Instantaneous trip.

b. Long- and short-time pickup levels.
c. Long- and short-time time adjustments.
d. Ground-fault pickup level, time delay, and I squared x t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.
b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
c. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
d. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

2.7 IDENTIFICATION

A. Create a directory to indicate installed circuit loads[after balancing panelboard loads]; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

B. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

C. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Isolated-ground receptacles.
3. Tamper-resistant receptacles.
4. Snap switches and wall-box dimmers.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Wiring Devices, Inc.
2. Hubbell.
3. Leviton Manufacturing Co., Inc.
4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cooper Wiring Devices, Inc.
b. Hubbell.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, feed [through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cooper Wiring Devices, Inc.
b. Hubbell.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

2.5 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, [provide one of the following [

a. Single Pole:

1) Cooper; AH1221.
2) Hubbell; HBL1221.
3) Leviton; 1221-2.
4) Pass & Seymour; CSB20AC1.

b. Two Pole:

1) Cooper; AH1222.

2) Hubbell; HBL1222.
3) Leviton; 1222-2.
4) Pass & Seymour; CSB20AC2.

c. Three Way:

1) Cooper; AH1223.
2) Hubbell; HBL1223.
3) Leviton; 1223-2.
4) Pass & Seymour; CSB20AC3.

C. Pilot-Light Switches, 20 A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cooper Wiring Devices, Inc.
b. Hubbell.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

D. Tamper-Resistant and Weather-Resistant Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cooper Wiring Devices, Inc.
b. Hubbell.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section, when installed in wet and damp locations.

E. GFCI,[Feed] []-Through Type, Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and UL 943 Class A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cooper Wiring Devices, Inc.
b. Hubbell.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

F. GFCI, Tamper-Resistant and Weather-Resistant Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and UL 943 Class A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cooper Wiring Devices, Inc.
b. Hubbell.
c. Pass & Seymour/Legrand (Pass & Seymour).

2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section.

G. Toggle Switches, Square Face, 120/277 V, 15 A: Comply with NEMA WD 1, UL 20, and FS W-S-896.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cooper Wiring Devices, Inc.
b. Hubbell.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

2.6 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- (1-mm-) thick, satin-finished, Type 302 stainless steel.
3. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant die-cast aluminum with lockable cover.

2.7 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: [[Ivory [[< > unless otherwise indicated or required by NFPA 70 or device listing.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.

9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right [

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections[
1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.

3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Test straight-blade for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g).

D. Wiring device will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600 V ac and less for use in the following:

   a. Control circuits.
   b. Enclosed switches.

2. Spare-fuse cabinets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

   a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
   b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Current-limitation curves for fuses with current-limiting characteristics.
4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit in electronic format suitable for use in coordination software and in PDF format.
5. Coordination charts and tables and related data.
6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017700 "Closeout Procedures," Section 017823 "Operation and Maintenance Data,"]include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse used on the Project. Submit in electronic format suitable for use in coordination software and in PDF format.
4. Coordination charts and tables and related data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.6 FIELD CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussmann; a division of Cooper Industries.
2. Edison; a brand of Cooper Bussmann; a division of Cooper Industries.
3. Littelfuse, Inc.

B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

1. Type RK-1: 600-V, zero- to 600-A rating, 200 kAIC, time delay.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Motor Branch Circuits: Class RK1 [] [time delay.
2. Other Branch Circuits: Class RK1, time delay [] [].
3. Control Transformer Circuits: Class CC, time delay, control transformer duty.
4. Provide open-fuse indicator fuses or fuse covers with open fuse indication.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. .
4. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 PERFORMANCE REQUIREMENTS

1.5 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
5. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Submit on translucent log-log graph paper.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

1.9 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m).

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Owner's written permission.
4. Comply with NFPA 70E.

1.11 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Wiring Devices, Inc.
2. Eaton Electrical Sector; Eaton Corporation.
3. General Electric Company.
4. Siemens Industry, Inc.
5. Square D.

B. Type HD, Heavy Duty, Single Throw, 240] [V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate [indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Lugs: Mechanical type, suitable for number, size, and conductor material.
8. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Wiring Devices, Inc.
2. Eaton Electrical Sector; Eaton Corporation.
3. General Electric Company.
4. Siemens Industry, Inc.
5. Square D.

B. Type HD, Heavy Duty, Single Throw, 240 V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
5. Hookstick Handle: Allows use of a hookstick to operate the handle.
6. Lugs:Mechanical type, suitable for number, size, and conductor material.
7. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.
8. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
9. Form C alarm contacts that change state when switch is tripped.

2.3 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 3 R.
4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

END OF SECTION 262816

SECTION 262913 - ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following enclosed controllers rated 600 V and less:

1. Full-voltage manual.
2. Full-voltage magnetic.

B. Related Section:

1. Section 262923 "Variable-Frequency Motor Controllers"

1.3 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. MCP: Motor circuit protector.

D. N.C.: Normally closed.

E. N.O.: Normally open.

F. OCPD: Overcurrent protective device.

G. SCR: Silicon-controlled rectifier.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed controllers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.

B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.

1. Show tabulations of the following:

a. Each installed unit's type and details.
b. Factory-installed devices.
c. Nameplate legends.
d. Short-circuit current rating of integrated unit.
e. Listed and labeled for integrated short-circuit current (withstand) rating of OCPDs in combination controllers by an NRTL acceptable to authorities having jurisdiction.
f. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.

2. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Certificates: For enclosed controllers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

D. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

E. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for enclosed controllers and installed components.
2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
3. Manufacturer's written instructions for setting field-adjustable overload relays.
4. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage solid-state controllers.

1.8 MATERIALS MAINTENANCE SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
3. Indicating Lights: Two of each type and color installed.
4. Auxiliary Contacts: Furnish one spare for each size and type of magnetic controller installed.
5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

1.9 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. If stored in areas subject to weather, cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers.

1.11 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m).

B. Interruption of Existing Electrical Systems: Do not interrupt electrical systems in facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Owner no fewer than Seven days in advance of proposed interruption of electrical systems.
2. Indicate method of providing temporary utilities.
3. Do not proceed with interruption of electrical systems without Owner's written permission.
4. Comply with NFPA 70E.

1.12 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 FULL-VOLTAGE CONTROLLERS

A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Eaton Electrical Sector; Eaton Corporation.
b. General Electric Company.
c. Rockwell Automation, Inc.
d. Siemens Industry, Inc.
e. Square D.

2. Configuration: Nonreversing.
3. Surface mounting.
4. Red Green pilot light.

C. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Eaton Electrical Sector; Eaton Corporation.
   b. General Electric Company.
   c. Rockwell Automation, Inc.
   d. Siemens Industry, Inc.
   e. Square D.

2. Configuration:
3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 <t > tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type.
4. Surface mounting.
5. Red Green pilot light.

D. Integral Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Eaton Electrical Sector; Eaton Corporation.
   b. General Electric Company.
   c. Rockwell Automation, Inc.
   d. Siemens Industry, Inc.
   e. Square D.

2. Configuration: Nonreversing
3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters and sensors in each phase, matched to nameplate full-load current of actual protected motor and having appropriate adjustment for duty cycle; external reset push button; bimetallic type.
4. Surface mounting.
5. Red Green pilot light.
6. Aauxiliary contacts as shown on drawing.

E. Magnetic Controllers: Full voltage, across the line, electrically held.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Eaton Electrical Sector; Eaton Corporation.
   b. General Electric Company.
   c. Rockwell Automation, Inc.
   d. Siemens Industry, Inc.
   e. Square D.

2. Configuration: Nonreversing
3. Contactor Coils: Pressure-encapsulated type

    a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.

4. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
5. Control Circuits: 120V ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.

    a. CPT Spare Capacity: 50VA.

6. Melting Alloy Overload Relays:

    a. Inverse-time-current characteristic.
    b. Class 20 tripping characteristic.
    c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

7. N.O. isolated overload alarm contact.
8. External overload reset push button.

F. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.

G. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company.
3. Rockwell Automation, Inc.
4. Siemens Industry, Inc.
5. Square D.

6. Fusible Disconnecting Means:

    a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class R fuses.
    b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

7. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
8. Nonfusible Disconnecting Means:

    a. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
    b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
    c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.

2.2 ENCLOSURES

A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations:Type 1.
2. Outdoor Locations: Type 3R.

2.3 ACCESSORIES

A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches:[Heavy [duty,] type.

a. Push Buttons: Recessed types; momentary as indicated.
b. Pilot Lights: Transformer types; colors as indicated;
c. Selector Switches: Rotary type.
d. Reversible N.C./N.O. auxiliary contact(s).

B. Control Relays: Auxiliary and adjustable solid-state time-delay relays.

C. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

D. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.

E. Cover gaskets for Type 1 enclosures.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in each fusible-switch enclosed controller.

D. Install fuses in control circuits if not factory installed. Comply with requirements in Section 262813 "Fuses."

E. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

F. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

G. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

3.4 CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controllers and remote devices Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."

B. Bundle, train and support wiring in enclosures.

C. Connect selector switches and other automatic-control selection devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

D. Tests and Inspections:

1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Owner before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Perform the following infrared (thermographic) scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each multi-pole enclosed controller. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each multi-pole enclosed controller 11 months after date of Substantial Completion.
c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

E. Enclosed controllers will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.

C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify [Owner before increasing settings.

D. Set field-adjustable switches and program microprocessors for required start and stop sequences in reduced-voltage solid-state controllers.

E. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

3.7 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.

B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.

END OF SECTION 262913

SECTION 263600 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes transfer switches rated 600 V and less, including the following:

1. Automatic transfer switches.
2. Remote annunciation and control systems.

1.2 ACTION SUBMITTALS

A. Product Data: Provide rated capacities, weights, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists.

1. Single-Line Diagram: Show connections between transfer switch power sources, and load; and show interlocking provisions for remote pump drive interlock.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA ICS 1.

E. Comply with NFPA 70.

F. Comply with NFPA 110 for standby power requirements.

G. Comply with UL 1008 unless requirements of these Specifications are stricter.

PART 2 - PRODUCTS

2.1 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer .

B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplish by a non-fused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
1. Switch Action: Double throw; mechanically held in both directions.
2. Contacts: Silver composition or silver alloy for load-current switching with separate arcing contacts.

G. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

H. Annunciation, Control, and Programming Interface Components: Transfer switch shall be provided with a minimum of two contacts for providing signal of position status to remote programming devices .

I. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Section 260553 "Identification for Electrical Systems."

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

J. Enclosures: General-purpose NEMA 250, Type 1 , complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.2 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 2 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

D. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.

E. Status Contacts: Two sets of normally open/normally closed dry contacts operates to indicate switch position of Normal/Alternate.

F. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

G. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.

H. Automatic Transfer-Switch Features:

1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

    a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
    b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Instantaneous; shall initiate shutdown sequence at remote engine-generator controls after retransfer of load to normal source.
12. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.

13. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
    b. Push-button programming control with digital display of settings.
    c. Integral battery operation of time switch when normal control power is not available.

2.3 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

END OF SECTION 263600

SECTION 264113 - LIGHTNING PROTECTION FOR STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes lightning protection for structures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For air terminals and mounting accessories.

1. Layout of the lightning protection system, along with details of the components to be used in the installation.
2. Include indications for use of raceway, data on how concealment requirements will be met, and calculations required by NFPA 780 for bonding of grounded and isolated metal bodies.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and manufacturer. Include data on listing or certification by UL.

B. Certification, signed by Contractor, that roof adhesive is approved by manufacturer of roofing material.

C. Field quality-control reports.

D. Comply with recommendations in NFPA 780, Annex D, "Inspection and Maintenance of Lightning Protection Systems," for maintenance of the lightning protection system.

E. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features, including the following:

1. Ground rods.
2. Ground loop conductor.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Certified by UL]or LPI as a Master Installer/Designer, trained and approved for installation of units required for this Project.

B. System Certificate:

1. UL Master Label.
2. LPI System Certificate.
3. UL Master Label Recertification.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 780, "Definitions" Article.

1.6 COORDINATION

A. Coordinate installation of lightning protection with installation of other building systems and components, including electrical wiring, supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.

B. Coordinate installation of air terminals attached to roof systems with roofing manufacturer and Installer.

C. Flashings of through-roof assemblies shall comply with roofing manufacturers' specifications.

PART 2 - PRODUCTS

2.1 LIGHTNING PROTECTION SYSTEM COMPONENTS

A. Comply with UL 96 and NFPA 780.

B. Roof-Mounted Air Terminals: NFPA 780, Class I [] copper unless otherwise indicated.

1. Air Terminals More than 24 Inches (600 mm) Long: With brace attached to the terminal at not less than half the height of the terminal.
2. Single-Membrane, Roof-Mounted Air Terminals: Designed specifically for single-membrane roof system materials. Comply with requirements in roofing Sections.

C. Main and Bonding Conductors: Copper.

D. Ground Loop Conductor: The same size and type as the main conductor except tinned.

E. Ground Rods: Copper-clad, sectional type; 3/4 inch (19 mm) in diameter by 10 feet (3 m) long.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lightning protection components and systems according to UL 96A and NFPA 780

B. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends.

C. Conceal the following conductors:

1. System conductors.
2. Down conductors.
3. Interior conductors.
4. Conductors within normal view of exterior locations at grade within 200 feet (60 m) of building.

D. Cable Connections: Use crimped or bolted connections for all conductor splices and connections between conductors and other components. Use exothermic-welded connections in underground portions of the system.

E. Cable Connections: Use exothermic-welded connections for all conductor splices and connections between conductors and other components.

1. Exception: In single-ply membrane roofing, exothermic-welded connections may be used only below the roof level.

F. Air Terminals on Single-Ply Membrane Roofing: Comply with roofing membrane and adhesive manufacturer's written instructions.

G. Bond extremities of vertical metal bodies exceeding 60 feet (18 m) in length to lightning protection components.

H. Ground Loop: Install ground-level, potential equalization conductor and extend around the perimeter of structure.

1. Bury ground ring not less than 24 inches (600 mm) from building foundation.
2. Bond ground terminals to the ground loop.
3. Bond grounded building systems to the ground loop conductor within 12 feet (3.6 m) of grade level.

I. Bond lightning protection components with intermediate-level interconnection loop conductors to grounded metal bodies of building at 60-foot (18-m) intervals.

3.2 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.3 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

B. Use conductors with protective coatings where conditions cause deterioration or corrosion of conductors.

3.4 FIELD QUALITY CONTROL

A. Notify Architect at least 48 hours in advance of inspection before concealing lightning protection components.

B. UL Inspection: Meet requirements to obtain a UL Master Label for system.

C. LPI System Inspection: Meet requirements to obtain an LPI System Certificate.

END OF SECTION 264113

SECTION 264313 -

SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

B. Related Requirements:

1. Section 262413 "Switchboards" for factory-installed SPDs.
2. Section 262416 "Panelboards" for factory-installed SPDs.

1.3 DEFINITIONS

A. Inominal: Nominal discharge current.

B. MCOV: Maximum continuous operating voltage.

C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SPD: Surge protective device.

H. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449.

D. MCOV of the SPD shall be the nominal system voltage.

2.2 SERVICE ENTRANCE AND TRANSFER SWITCH SUPPRESSOR

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB USA.
2. Advanced Protection Technologies Inc. (APT).
3. Current Technology Inc.
4. Eaton Electrical Sector; Eaton Corporation.
5. General Electric Company.
6. Liebert; a brand of Emerson Electric Co.

B. SPDs: Comply with UL 1449, Type 2.

C. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 2

1. SPDs with the following features and accessories:
   a. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
   b. Indicator light display for protection status.
   c. Form-C contacts rated at 5 A and 250-V ac
   d. Surge counter

D. Comply with UL 1283.

E. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 320 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

F. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 1200 V for 480Y/277 V
2. Line to Ground:[1200 V for 480Y/277 V
3. Line to Line: 2000 V for 480Y/277 V

G. SCCR: Equal or exceed 100 kA.

H. Inominal Rating: 20 kA.

2.3 PANEL SUPPRESSORS

A. Retain this article for SPDs other than those installed at the service entrance. SPD described in this article is required by NFPA 70 to be installed with OCPD. The type and size of OCPD depends on the UL listing requirements. See "SPD Types" Article in the Evaluations.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB USA.
2. Current Technology Inc.
3. Eaton Electrical Sector; Eaton Corporation.
4. General Electric Company.
5. Liebert; a brand of Emerson Electric Co.

C. SPDs: Comply with UL 1449, Type 2.

1. Include LED indicator lights for power and protection status.
2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.

3. Include Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status.

D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

E. Comply with UL 1283.

F. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 1200 V for 480Y/277 V.
2. Line to Ground: 1200 V for 480Y/277 V.
3. Neutral to Ground: 1200 V for 480Y/277 V.
4. Line to Line: 2000 V for 480Y/277 V.

G. Protection modes and UL 1449 VPR for 240/120-V, single-phase, three-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V.
2. Line to Ground: 700 V.
3. Neutral to Ground: 700 V.
4. Line to Line: 1200 V.

H. SCCR: Equal or exceed 100 kA.

I. Inominal Rating: 20 kA

2.4 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

2.5 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Class 2 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 14 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.

C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

E. Wiring:

1. Power Wiring: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
2. Controls: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. An SPD will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 STARTUP SERVICE

A. Complete startup checks according to manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION 264313

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.
5. Retrofit kits for fluorescent lighting fixtures.

B. Related Sections:
1. Section 262726 "Wiring Devices" for manual wall-box dimmers.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Ballast, including BF.

4. Energy-efficiency data.
5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
    b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Samples: For each lighting fixture indicated in the Interior Lighting Fixture Schedule. Each Sample shall include the following:

1. Lamps and ballasts, installed.
2. Cords and plugs.
3. Pendant support system.

D. Installation instructions.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Lighting fixtures.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extends to within 12 inches (305 mm) of the plane of the luminaires.
4. Ceiling-mounted projectors.
5. Structural members to which suspension systems for lighting fixtures will be attached.
6. Other items in finished ceiling including the following:

    a. Air outlets and inlets.
    b. Sprinklers.
    c. Smoke and fire detectors.
    d. Occupancy sensors.

e. Access panels.
f. Perimeter moldings.

B. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

C. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps:10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Plastic Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

E. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

1.9 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.10 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

C. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.

D. Metal Parts: Free of burrs and sharp corners and edges.

E. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

G. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

   a. Lens Thickness: At least 0.125 inch (3.175 mm) < > minimum unless otherwise indicated.
   b. UV stabilized.

2. Glass: Annealed crystal glass unless otherwise indicated.

H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

   a. "USE ONLY" and include specific lamp type.
   b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
   c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
   d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
   e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
   f. CCT and CRI for all luminaires.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. General Requirements for Electronic Ballasts:

1. Comply with UL 935 and with ANSI C82.11.
2. Designed for type and quantity of lamps served.
3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
4. Sound Rating: Class A
5. Total Harmonic Distortion Rating: Less than 10 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Operating Frequency: 42 kHz or higher.
8. Lamp Current Crest Factor: 1.7 or less.
9. BF: 0.90 or higher.
10. Power Factor: 0.95 or higher.
11. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

B. luminaires controlled by occupancy sensors shall have programmed-start ballasts.

C. Electronic Programmed-Start Ballasts for T8 Lamps: Comply with ANSI C82.11 and the following:

1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.

2. Automatic lamp starting after lamp replacement.

D. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.

1. Ballast Manufacturer Certification: Indicated by label.

E. Single Ballasts for Multiple Lighting Fixtures: Factory wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.

F. Ballasts for Low-Temperature Environments:

1. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.
2. Temperatures Minus 20 Deg F (Minus 29 Deg C) and Higher: Electromagnetic type designed for use with indicated lamp types.

G. Ballasts for Residential Applications: Fixtures designated as "Residential" may use low-power-factor electronic ballasts having a Class B sound rating and total harmonic distortion of approximately 30 percent.

H. Ballasts for Low Electromagnetic-Interference Environments: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for consumer equipment.

1. Ballast shall provide equal current to each lamp in each operating mode.
2. Compatibility: Certified by manufacturer for use with specific tri-level control system and lamp type indicated.

2.4 BALLASTS FOR HID LAMPS

A. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C) for single-lamp ballasts.
3. Rated Ambient Operating Temperature: 104 deg F (40 deg C).
4. Open-circuit operation that will not reduce average life.
5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.

B. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:

1. Minimum Starting Temperature: Minus 20 deg F (Minus 29 deg C) for single-lamp ballasts.
2. Rated Ambient Operating Temperature: 130 deg F (54 deg C).
3. Lamp end-of-life detection and shutdown circuit.

4. Sound Rating: Class A.
5. Total Harmonic Distortion Rating: Less than 20 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Lamp Current Crest Factor: 1.5 or less.
8. Power Factor: 0.90 or higher.
9. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
10. Protection: Class P thermal cutout.
11. Bi-Level Dimming Ballast: Ballast circuit and leads provide for remote control of the light output of the associated fixture between high- and low-level and off.

    a. High-Level Operation: 100 percent of rated lamp lumens.
    b. Low-Level Operation: 35 percent of rated lamp lumens.
    c. Compatibility: Certified by ballast manufacturer for use with specific bi-level control system and lamp type indicated. Certified by lamp manufacturer that ballast operating modes are free from negative effect on lamp life and color-rendering capability.

2.5 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.6 FLUORESCENT LAMPS

A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours unless otherwise indicated.

B. T8 rapid-start lamps, rated 17 W maximum, nominal length of 24 inches (610 mm), 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life of 20,000 hours unless otherwise indicated.

2.7 HID LAMPS

A. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65 < >, and color temperature 4000 K.

B. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K.

2.8 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm)

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).

F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.

3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Verify that self-luminous exit signs are installed according to their listing and the requirements in NFPA 101.

C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 265100

SECTION 265600 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior luminaires with lamps and ballasts.
2. Luminaire-mounted photoelectric relays.

B. Related Sections:

1. Section 265100 "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. HID: High-intensity discharge.

D. LER: Luminaire efficacy rating.

E. Luminaire: Complete lighting fixture, including ballast housing if provided.

F. Pole: Luminaire support structure, including tower used for large area illumination.

G. Standard: Same definition as "Pole" above.

1.4 ACTION SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.

4. Luminaire materials.
5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.

    a. Testing Agency Certified Data: For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
    b. Manufacturer Certified Data: Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

6. Photoelectric relays.
7. Ballasts, including energy-efficiency data.
8. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.
9. Materials, dimensions, and finishes of poles.
10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
11. Anchor bolts for poles.
12. Manufactured pole foundations.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
3. Design calculations, certified by a qualified professional engineer, indicating strength of screw foundations and soil conditions on which they are based.
4. Wiring Diagrams: For power, signal, and control wiring.

C. Samples: For products designated for sample submission in the Exterior Lighting Device Schedule. Each Sample shall include lamps and ballasts.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

B. Field quality-control reports.

C. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: One for every 100 of each type and rating installed. Furnish at least one of each type.
2. Glass and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with IEEE C2, "National Electrical Safety Code."

E. Comply with NFPA 70.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
3. Warranty Period for Color Retention: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

1. LER Tests Incandescent Fixtures: Where LER is specified, test according to NEMA LE 5A.
2. LER Tests Fluorescent Fixtures: Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
3. LER Tests HID Fixtures: Where LER is specified, test according to NEMA LE 5B.

B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping.

M. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

a. "USES ONLY" and include specific lamp type.
b. Lamp diameter code (T-4, T-5, T-8, T-12), tube configuration (twin, quad, triple), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
d. Start type (preheat, rapid start, instant start) for fluorescent and compact fluorescent luminaires.
e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
f. CCT and CRI for all luminaires.

2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Comply with UL 773 or UL 773A.

B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.

1. Relay with locking-type receptacle shall comply with ANSI C136.10.
2. Adjustable window slide for adjusting on-off set points.

2.4 BALLASTS FOR HID LAMPS

A. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. Include the following features unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C).
3. Normal Ambient Operating Temperature: 104 deg F (40 deg C).
4. Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.

2.5 HID LAMPS

A. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65, and CCT color temperature 4000 K.

B. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and CCT color temperature 4000 K.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.2 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

1. Verify operation of photoelectric controls.

C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 265600

PROPRIETARY/CONFIDENTIAL INFORMATION IDENTIFICATION

ATTACHMENT A2

Name of Firm/Offeror:_____

Trade secrets or proprietary information submitted by an offeror shall not be subject to public disclosure under the Virginia Freedom of Information Act; however, the offeror must invoke the protections of §2.2-4342F of the Code of Virginia, in writing, either before or at the time the data or other material is submitted. The written notice must specifically identify the data or materials to be protected, including the section of the proposal in which it is contained, as well as the page number(s), and state the reasons why protection is necessary. The proprietary or trade secret material submitted must be identified by some distinct method such as highlighting or underlining and must indicate only the specific words, figures, or paragraphs that constitute a trade secret or proprietary information. In addition, a summary of proprietary information provided shall be submitted on this form. The designation of an entire proposal document, line item prices, and/or total proposal prices as proprietary or trade secrets is not acceptable. If, after being given reasonable time, the offeror refuses to withdraw such a classification designation, the proposal will be rejected.

SECTION/TITLE	PAGE NUMBER(S)	REASON(S) FOR WITHHOLDING FROM DISCLOSURE

☐ Check this box if there are none.

ATTACHMENT A3

State Corporation Commission Form

Virginia State Corporation Commission ("SCC") registration information: **The undersigned Offeror:**

☐ is a corporation or other business entity with the following SCC identification number: _____ **-OR-**

☐ is not a corporation, limited liability company, limited partnership, registered limited liability partnership, or business trust **-OR-**

☐ is an out-of-state business entity that does not regularly and continuously maintain as part of its ordinary and customary business any employees, agents, offices, facilities, or inventories in Virginia (not counting any employees or agents in Virginia who merely solicit orders that require acceptance outside Virginia before they become contracts, and not counting any incidental presence of the Offeror in Virginia that is needed in order to assemble, maintain, and repair goods in accordance with the contracts by which such goods were sold and shipped into Virginia from bidder's out-of-state location) **-OR-**

☐ is an out-of-state business entity that is including with this RFP an opinion of legal counsel which accurately and completely discloses the undersigned Offeror's current contacts with Virginia and describes why those contacts do not constitute the transaction of business in Virginia within the meaning of § 13.1-757 or other similar provisions in Titles 13.1 or 50 of the Code of Virginia.

****NOTE** >>** Check the following box if you have not completed any of the foregoing options but currently have pending before the SCC an application for authority to transact business in the Commonwealth of Virginia and wish to be considered for a waiver to allow you to submit the SCC identification number after the due date for proposals (the Commonwealth reserves the right to determine in its sole discretion whether to allow such waiver):

Signature: _____ Date: _____

Name: _____
Print

Title: _____

Name of Firm: _____

GENERAL TERMS AND CONDITIONS FOR THE CITY OF HARRISONBURG, VA

PURCHASING AND CONTRACTING MANUAL: This solicitation is subject to the provisions of The Purchasing and Contracting Policy Manual for the City of Harrisonburg (City) and any revisions thereto, which are hereby incorporated into this contract in their entirety. A copy of the manual is available for review at www.Harrisonburgva.gov/bids.

APPLICABLE LAWS AND COURTS: This solicitation and any resulting contract shall be governed in all respects by the laws of the Commonwealth of Virginia and any litigation with respect thereto shall be brought in the courts of the Commonwealth. The contractor shall comply with all applicable federal, state and local laws, rules and regulations.

ANTI-DISCRIMINATION: By submitting their (bids/proposals), (bidders/offerors) certify to the City that they will conform to the provisions of the Federal Civil Rights Act of 1964, as amended, as well as the Virginia Fair Employment Contracting Act of 1975, as amended, where applicable, the Virginians With Disabilities Act, the Americans With Disabilities Act and 2.2-4311 of the *Virginia Public Procurement Act*.

In every contract over $10,000 the provisions below apply:

1. During the performance of this contract, the contractor agrees as follows:

   a. The contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, age, disability, or any other basis prohibited by state law relating to discrimination in employment, except where there is a bona fide occupational qualification reasonably necessary to the normal operation of the contractor. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.

   b. The contractor, in all solicitations or advertisements for employees placed by or on behalf of the contractor, will state that such contractor is an equal opportunity employer.

   c. Notices, advertisements and solicitations placed in accordance with federal law, rule or regulation shall be deemed sufficient for the purpose of meeting these requirements.

   The contractor will include the provisions of 1. above in every subcontract or purchase order over $10,000, so that the provisions will be binding upon each subcontractor or vendor.

2. The City does not discriminate against small and minority businesses or faith based organizations.

ETHICS IN PUBLIC CONTRACTING: By submitting their (bids/proposals), (bidders/offerors) certify that their (bids/proposals) are made without collusion or fraud and that they have not offered or received any kickbacks or inducements from any other (bidder/offeror), supplier, manufacturer or subcontractor in connection with their (bid/proposal), and that they have not conferred on any public employee having official responsibility for this procurement transaction any payment, loan, subscription, advance, deposit of money, services or anything of more than nominal value, present or promised, unless consideration of substantially equal or greater value was exchanged.

IMMIGRATION REFORM AND CONTROL ACT OF 1986: By submitting their (bids/proposals), (bidders/offerors) certify that they do not and will not during the performance of this contract employ illegal alien workers or otherwise violate the provisions of the federal Immigration Reform and Control Act of 1986.

DEBARMENT STATUS: By submitting their (bids/proposals), (bidders/offerors) certify that they are not currently debarred by the Commonwealth of Virginia from submitting bids or proposals on contracts for the type of goods and/or services covered by this solicitation, nor are they an agent of any person or entity that is currently so debarred.

ANTITRUST: By entering into a contract, the contractor conveys, sells, assigns, and transfers to the City all rights, title and interest in and to all causes of action it may now have or hereafter acquire under the antitrust laws of the United States and the Commonwealth of Virginia, relating to the particular goods or services purchased or acquired by the City under said contract.

MANDATORY USE OF CITY FORM AND TERMS AND CONDITIONS FOR IFBs AND RFPs

1. (For Invitation For Bids(ITB):) Failure to submit a bid on the form provided, (if provided) shall be a cause for rejection of the bid. Modification of or additions to any portion of the Invitation for Bids may be cause for rejection of the bid; however, the City reserves the right to decide, on a case by case basis, in its sole discretion, whether to reject such a bid as nonresponsive. As a precondition to its acceptance, the City may, in its sole discretion, request that the bidder withdraw or modify nonresponsive portions of a bid which do not affect quality, quantity, price, or delivery. No modification of or addition to the provisions of the contract shall be effective unless reduced to writing and signed by the parties.

2. (For Request For Proposals(RFP):) Failure to submit a proposal on the form provided, (if provided) shall be a cause for rejection of the bid. Modification of or additions to the General Terms and Conditions of the solicitation may be cause for rejection of the proposal; however, the City reserves the right to decide, on a case by case basis, in its sole discretion, whether to reject such a proposal.

REVISIONS TO THE OFFICIAL ITB/RFP: No offeror shall modify, revise, edit or make any unauthorized change(s) to the original Official Invitation to Bid (ITB) or Official Request for

Proposal (RFP). The Official solicitation document and the Addenda(s) are the documents posted on the City of Harrisonburg's web site and/or authorized by the City of Harrisonburg's Purchasing Agent. Any such violation as stated above may result in rejection of the ITB/RFP response. In addition, violations may result in the debarment of the offeror by the City of Harrisonburg.

CLARIFICATION OF TERMS: If any prospective (bidder/offeror) has questions about the specifications or other solicitation documents, the prospective (bidder/offeror) should contact the person whose name appears on the face of the solicitation no later than five working days before the due date. Any revisions to the solicitation will be made only by addendum issued by the buyer.

PAYMENT:

1. To Prime Contractor:

   a. Invoices for items ordered, delivered and accepted shall be submitted by the contractor directly to the payment address shown on the purchase order/contract. All invoices shall show the purchase order number; social security number (for individual contractors) or the federal employer identification number (for proprietorships, partnerships, and corporations).

   b. Any payment terms requiring payment in less than 30 days will be regarded as requiring payment 30 days after invoice or delivery, whichever occurs last. This shall not affect offers of discounts for payment in less than 30 days, however.

   c. All goods or services provided under this contract or purchase order, that are to be paid for with public funds, shall be billed by the contractor at the contract price.

   d. The following shall be deemed to be the date of payment: the date of postmark in all cases where payment is made by mail, or the date of offset when offset proceedings have been instituted as authorized under the Virginia Debt Collection Act.

   e. Individual contractors shall provide their social security numbers, and proprietors , partnerships, and corporations shall provide the City with a federal employer identification number, prior to receiving any payment from the City.

   f. **Unreasonable Charges**. Under certain emergency procurements and for most time and material purchases, final job costs cannot be accurately determined at the time orders are placed. In such cases, contractors should be put on notice that final payment in full is contingent on a determination of reasonableness with respect to all invoiced charges. Charges which appear to

be unreasonable will be researched and challenged, and that portion of the invoice held in abeyance until a settlement can be reached. Upon determining that invoiced as to those charges which it considers unreasonable and the basis for the determination. A contractor may not institute legal action unless a settlement cannot be reached within thirty (30) days of notification. The provisions of this section do not relieve the City of its prompt payment obligations with respect to those charges which are not in dispute (*Code of Virginia*, 2.2.4363.

2. To Subcontractors:

   a. A contractor awarded a contract under this solicitation is hereby obligated:

      (1) To pay the subcontractor(s) within seven (7) days of the contractor's receipt of payment from the City for the proportionate share of the payment received for work performed by the subcontractor(s) under the contract; or

      (2) To notify the City and the subcontractor(s), in writing, of the contractor's intention to withhold payment and the reason.

   b. The contractor is obligated to pay the subcontractor(s) interest at the rate of one percent per month (unless otherwise provided under the terms of the contract) on all amounts owed by the contractor that remain unpaid seven (7) days following receipt of payment from the City, except for amounts withheld as stated in (2) above. The date of mailing of any payment by U. S. Mail is deemed to be payment to the addressee. These provisions apply to each sub-tier contractor performing under the primary contract. A contractor's obligation to pay an interest charge to a subcontractor may not be construed to be an obligation of the City.

PRECEDENCE OF TERMS: General Terms and Conditions shall apply in all instances. In the event there is a conflict between any of the other General Terms and Conditions and any Special Terms and Conditions in this solicitation, the Special Terms and Conditions shall apply.

QUALIFICATIONS OF (BIDDERS/OFFERORS): The City may make such reasonable investigations as deemed proper and necessary to determine the ability of the (bidder/offeror) to perform the services/furnish the goods and the (bidder/offeror) shall furnish to the City all such information and data for this purpose as may be requested. The City reserves the right to inspect (bidder's/offeror's) physical facilities prior to award to satisfy questions regarding the (bidder's/offeror's) capabilities. The City further reserves the right to reject any (bid/ proposal) if the evidence submitted by, or investigations of, such (bidder/offeror) fails to satisfy the City that such (bidder/offeror) is properly qualified to carry out the obligations of the contract and to provide the services and/or furnish the goods contemplated therein.

TESTING AND INSPECTION: The City reserves the right to conduct any test/inspection it may deem advisable to assure goods and services conform to the specifications.

ASSIGNMENT OF CONTRACT: A contract shall not be assignable by the contractor in whole or in part without the written consent of the City.

CHANGES TO THE CONTRACT: Changes can be made to the contract in any of the following ways:

1. The parties may agree in writing to modify the scope of the contract. An increase or decrease in the price of the contract resulting from such modification shall be agreed to by the parties as a part of their written agreement to modify the scope of the contract.
2. The Purchasing Agent or City delegated agent may order changes within the general scope of the contract at any time by written notice to the contractor. Changes within the scope of the contract include, but are not limited to, things such as services to be performed, the method of packing or shipment, and the place of delivery or installation. The contractor shall comply with the notice upon receipt. The contractor shall be compensated for any additional costs incurred as the result of such order and shall give the City a credit for any savings.

DEFAULT: In case of failure to deliver goods or services in accordance with the contract terms and conditions, the City, after due oral or written notice, may procure them from other sources and hold the contractor responsible for any resulting additional purchase and administrative costs. This remedy shall be in addition to any other remedies, which the City may have.

CANCELLATION OF THE CONTRACT: The City may terminate any agreement resulting from this solicitation at any time, for any reason or for no reason, upon thirty days advance written notice to the Contractor. In the event of such termination the Contractor shall be compensated for services and work performed prior to termination.

TAXES: Sales to the City of Harrisonburg are normally exempt from State sales tax. State sales and use tax certificates of exemption, Form ST-12, will be issued upon request.

(NOT NORMALLY REQUIRED FOR SERVICE CONTRACTS)

USE OF BRAND NAMES: Unless otherwise provided in this solicitation, the name of a certain brand, make or manufacturer does not restrict (bidders/offerors) to the specific brand, make or manufacturer named, but conveys the general style, type, character, and quality of the article desired. Any article which the public body, in its sole discretion, determines to be the equal of that specified, considering quality, workmanship, economy of operation, and suitability for the purpose intended, shall be accepted. The (bidder/offeror) is responsible to clearly and specifically identify the product being offered and to provide sufficient descriptive literature, catalog cuts and technical detail to enable the City to determine if the product offered meets the requirements of the solicitation. This is required even if offering the exact brand, make or manufacturer specified. Normally in

competitive sealed bidding only the information furnished with the bid will be considered in the evaluation. Failure to furnish adequate data for evaluation purposes may result in declaring a bid nonresponsive. Unless the (bidder/offeror) clearly indicates in its (bid/proposal) that the product offered is an "equal" product, such (bid/proposal) will be considered to offer the brand name product referenced in the solicitation.**(NOT NORMALLY REQUIRED FOR SERVICE CONTRACTS)**

TRANSPORTATION AND PACKAGING: By submitting their (bids/proposals), all (bidders/offerors) certify and warrant that the price offered for FOB destination includes only the actual freight rate costs at the lowest and best rate and is based upon the actual weight of the goods to be shipped. Except as otherwise specified herein, standard commercial packaging, packing and shipping containers shall be used. All shipping containers shall be legibly marked or labeled on the outside with purchase order number, commodity description, and quantity.**(NOT NORMALLY REQUIRED FOR SERVICE CONTRACTS)**

INSURANCE: By signing and submitting a bid or proposal under this solicitation, the bidder or offeror certifies that if awarded the contract, it will have insurance coverages per the solicitation document at the time the contract is awarded. For construction contracts, if any subcontractors are involved, the subcontractor will have workers' compensation insurance in accordance with 2.2-4332 and 65.2-800 et seq. of the *Code of Virginia*. The bidder or offeror further certifies that the contractor and any subcontractors will maintain these insurance coverages during the entire term of the contract and that all insurance coverages will be provided by insurance companies authorized to sell insurance in Virginia by the Virginia State Corporation Commission. **(NOT NORMALLY REQUIRED FOR GOODS CONTRACTS. INSURANCE IS REQUIRED WHEN WORK IS TO BE PERFORMED ON CITY OWNED OR LEASED FACILITIES OR PROPERTY.)**

AVAILABILITY OF FUNDS: Agreements are made subject to the appropriation of funds by the Harrisonburg City Council and are null and void in the event of non-appropriation by the City Council. Non-appropriation of funds shall not be deemed a cancellation and shall terminate this agreement without recourse and with no liability on the part of the City.

SELECTION PROCESS/AWARD: Upon the award or the announcement of the decision to award a contract as a result of this solicitation, the department will publicly post such notice for a minimum of ten (10) days, or will notify all responsive bidders/offerors.

BID/PROPOSAL ACCEPTANCE PERIOD: Any bid/proposal resulting from this solicitation shall be valid for (30) days. At the end of the (30) days the bid/proposal may be withdrawn at the written request of the Bidder/Offeror. If the bid or proposal is not withdrawn at that time it remains in effect until an award is made or the solicitation is canceled.

EXCUSABLE DELAY: The City shall not be in default of any failure in performance of this agreement in accordance with its terms if such failure arises out of causes beyond its reasonable control and without the fault of or negligence of the City. Such causes may include, but are not restricted to acts of God or the public enemy, fires, flood, epidemics,

quarantine restrictions, strikes, freight embargoes, and usually severe weather, but in every case the failure to perform must be beyond the reasonable control and without the fault or negligence of the City.

DRUG-FREE WORKPLACE: During the performance of this contract, the contractor agrees to (i) provide a drug-free workplace for the contractor's employees; (ii) post in conspicuous places, available to employees and applicants for employment, a statement notifying employees that the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance or marijuana is prohibited in the contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition; (iii) state in all solicitations or advertisements for employees placed by or on behalf of the contractor that the contractor maintains a drug-free workplace; and (iv) include the provisions of the foregoing clauses in every subcontract or purchase order of over $10,000, so that the provisions will be binding upon each subcontractor or vendor.

SAFETY and OSHA STANDARDS: All parties performing services for the City shall comply with all Occupational Safety and Health Administration (OSHA), State Occupational Health Standards, and any other applicable rules and regulations. All parties shall be held responsible for the training, supervision, and safety of their employees. Any unsafe acts or hazardous conditions that may cause injury or damage to any persons or property within and around the work site areas under this contract shall be remedied per the regulatory agency's guidelines.

PERMITS AND FEES: All proposals submitted shall have included in price the cost of any business or professional licenses, permits or fees required by the City of Harrisonburg or the Commonwealth of Virginia. The offeror must have all necessary licenses to perform the services in Virginia and, if practicing as a corporation, be authorized to do business in the Commonwealth of VA.

COOPERATIVE PROCUREMENT: This procurement is being conducted on behalf of other public bodies, in accordance with 2.2-4304 (A) of the Code of VA. The successful bidder has the option to provide these same items (services), except architectural and engineering services, at the same prices, awarded as a result of this solicitation to any public body within the Commonwealth of Virginia. If any other Public body decides to use the final contract, the contractor(s) must deal directly with that public body concerning the placement of orders, issuance of the purchase orders, contractual disputes, invoicing and payment. Failure to extend a contract to any public body will have no effect on consideration of your bid.

LIABILITY AND LITIGATION: The City shall not indemnify or hold harmless any Contractor or other third party. The City does not waive any right or release any party from liability, whether on its own behalf or on behalf of any boards, employees or agents. The City does not waive the right to trial by jury for any cause of action arising from the Contract and shall not submit any Contract claim to binding arbitration or mediation. The City shall not be liable to Contractor for any special, punitive or exemplary damages arising from the performance of the contract, including, but not limited to, incidental damages, and lost

profit and lost wages, even if such special damages are reasonably foreseeable. Any provision(s) in the Contract contrary to these statements is/are hereby deleted and rendered void.

STATE CORPORATION COMMISSION IDENTIFICATION NUMBER: Pursuant to Code of VA 2.2-4311.2 subsection B, a bidder or offeror organized or authorized to transact business in the Commonwealth pursuant to Title 13.1 or Title 50 is required to include in its bid or proposal the identification number issued to it by the State Corporation Commission (SCC). Any bidder or offeror that is not required to be authorized to transact business in the Commonwealth as a foreign business entity under Title 13.1 or Title 50 or as otherwise required by law is required to include in its bid or proposal a statement describing why the bidder or offeror is not required to be so authorized. Link to the SCC site is http://www.scc.virginia.gov.

ATTACHMENT A5

CITY OF HARRISONBURG, VA
STANDARD CONTRACT RFP

This Contract entered into this ___ day of _____ 20___, by _____ hereinafter called the "Contractor" and the City of Harrisonburg, VA, called the "Owner".

WITNESSETH that the Contractor and the Owner, in consideration of the mutual covenants, promises and agreements herein contained, agree as follows:

SCOPE OF CONTRACT: The Contractor shall provide the goods/services to the Owner as set forth in the Contract Documents.

PERIOD OF PERFORMANCE: From _____ through _____.

The contract documents shall consist of:

(1) This signed form;

(2) The entire City of Harrisonburg's Official Request for Proposals

dated: _____

If applicable, any Official City Addenda(s):

#1, dated: _____

(3) The Contractor's Proposal response dated _____ and the negotiated modifications (if applicable) to the Proposal, all of which documents are incorporated herein.

IN WITNESS WHEREOF, the parties have caused this Contract to be duly executed intending to be bound thereby.

CONTRACTOR: CITY OF HARRISONBURG (OWNER):

By: _____ By: _____

Title: _____ Title: _____